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UNIT-SPECIFIC TECHNICAL MEMORANDUM: UNDEVELOPED LAND DEBRIS PILE

PRATT & WHITNEY, EAST HARTFORD, CT

AREA: South Klondike

SUB-AREA: Undeveloped Land

RDMS DocID 00100181

ENVIRONMENTAL UNIT: Debris Pile

Location: South Klondike Area, south of a dirt road from Linde Road. This area is bounded on the west and south by wooded undeveloped land (Drawing 1).

Description: This unit consists of a large pile of landscaping debris. The surface of the pile was observed to contain predominantly grass clippings, wood chips, branches, trimmings, mulch, and black plastic landscaping edging. The source for the debris is unknown.

Dates of Operation: Unknown.

Processes: Placement of landscaping debris.

Aerial Photographs: Large-scale aerial photographs for 1965, 1970, and 1975 were obtained from Keystone Aerial Surveys, Inc. A review of these aerial photographs provided no information on the debris pile. No readily apparent debris or distinguishing characteristics are discernible from the aerial photos.

Specific Contaminants of Concern: The specific contaminants of concern are unknown. In order to be as comprehensive as possible in the investigation that was conducted, the following constituent groups were analyzed. These analyses included volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals (arsenic, barium, cadmium, chromium, mercury, nickel, selenium, silver, and zinc), polychlorinated biphenyls (PCBs), and total petroleum hydrocarbons (TPH).

Potential Release Mechanism: Impacts to soils and groundwater associated with potential spills, leaks, or materials leaching from the debris pile.

INVESTIGATION AND REMEDIATION ACTIVITIES:

Due to the potential for a release associated with the debris pile, a subsurface investigation to determine ~~the degree of~~ soil contamination was performed in February 1997. Prior to 1997 no investigation of the debris pile had reportedly been performed.

February 1997 Investigation (Loureiro Engineering Associates):

Description: On February 6 and 7, 1997, two soil borings, SK-SB-130 and SK-SB-131, were advanced in the vicinity of the debris pile by Loureiro Engineering Associates, P.C. (LEA). The sampling locations are shown on Drawing 1. Soil samples were collected from each boring in

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continuous two-foot intervals to a depth of sixteen feet. The depth of the borings was selected to ensure that sufficient data were collected for comparisons against direct exposure criteria in the Connecticut Remediation Standard Regulation (RSR).

A total of sixteen soil samples from the soil borings were submitted to the LEA Analytical Laboratory and screened for the presence of target VOCs (benzene (BZ), ethylbenzene (EBZ), tetrachloroethylene (PCE), toluene (TL), 1,1,1-trichloroethane (TCA), trichloroethylene (TCE), and xylenes (XYL)).. Based on visual, olfactory, or instrument evidence, and with consideration of the potential release mechanism, two samples from each boring were submitted to Averill Environmental Laboratory, Inc. (AEL) and analyzed for the presence of VOCs, metals, TPH, and PCBs. In addition, one soil sample from each boring was also analyzed for the presence of SVOCs.

Groundwater samples were also collected from both borings using Geoprobe® screenpoint groundwater sampling techniques. The groundwater samples were collected from a depth of nine to eleven feet below the ground surface. The groundwater samples were submitted to AEL for analysis of VOCs, SVOCs, metals, TPH, and PCBs. A summary of the samples collected and analyses performed is included in Table 1.

Investigation Results: Based on the boring logs, groundwater was encountered at approximately five feet in both borings. Varved clay was not encountered in either boring. No visual or olfactory evidence of contamination was noted in the boring logs.

Concentrations of constituents detected in soil samples collected for this unit are presented in Table 2. A complete summary of soil analytical results with detection limits is presented in Table 3. Detected concentrations are shown on Drawing 1. VOCs were not detected in the soil samples submitted to the LEA Analytical Laboratory or to AEL. Additionally, SVOCs, TPH, and PCBs were not detected in the soil samples submitted to AEL. However, fluoranthene (FA) was noted as "N1" in boring SK-SB-131 at 0 to 2 feet. The "N1" qualifier indicates that it was noted above the method detection limit, but below the reportable quantitation limit.

One or more of the metals analyzed were detected in each of the soil samples submitted for analysis. These metals include arsenic, barium, chromium, and zinc.

Concentrations of constituents detected in Geoprobe® screenpoint groundwater samples collected for this unit are presented in Table 4. A complete summary of groundwater analytical results with detection limits is presented in Table 5. VOCs, SVOCs, TPH, and PCBs were not detected in the groundwater samples submitted to AEL for analysis. Barium and mercury were detected in the Geoprobe® screenpoint groundwater sample from SK-SB-130. No other metals were detected in the groundwater samples submitted to AEL.

Data Evaluation and Conclusions: The soil boring data were compared against the default numeric criteria included in the RSR and the site-wide background soil concentrations for the North Klondike for various inorganic constituents (Fuss & O'Neill, 1994). For a more detailed discussion of background concentrations of metals in soil refer to *Technical Memorandum 4, Background Soil Data.* Criteria are established in the RSR based on exposure pathways for

various environmental media, including soil and groundwater. The evaluation of the soils data is based on a comparison to the residential direct exposure criteria (RDEC), the industrial/commercial direct exposure criteria, (IDEC) and the GB pollutant mobility criteria (GBPMC) included in the RSR.

The concentrations of the metals detected in the soil samples are typical of site-wide background concentrations, and are not indicative of a release from this unit. For the metals detected in soil, no exceedances of the default numeric RDEC or IDEC were noted. VOCs, SVOCs, TPH, and PCBs were not detected in either the soil samples or the groundwater samples collected and analyzed for this unit. Based on the results of the laboratory analyses of soil samples collected and analyzed for this unit, there is no evidence that a release occurred from this unit. As a result, the area has been adequately characterized and no further action is warranted for this unit.

Although an elevated concentration of mercury was detected in one of the groundwater samples collected and analyzed for this unit, the metals in the groundwater are believed to be natural. For a more detailed account of the groundwater sampling, including background concentrations for metals in groundwater, refer to *Technical Memorandum 3, Groundwater Sampling and Quality.*

REFERENCES:

Fuss & O'Neill, Inc., 1994, *Soil Sampling Background Areas – North Klondike*, prepared for Pratt & Whitney.

Keystone Aerial Surveys, Inc., 1965, *Aerial Photo of Rentschler Airport and Surrounding Areas*, East Hartford, CT.

Keystone Aerial Surveys, Inc., 1970, *Aerial Photo of Rentschler Airport and Surrounding Areas*, East Hartford, CT.

Keystone Aerial Surveys, Inc., 1975, *Aerial Photo of Rentschler Airport and Surrounding Areas*, East Hartford, CT.

TABLES

Table 1

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SUMMARY OF SAMPLING AND ANALYTICAL INFORMATION

P&W East Hartford: DEBRIS Pile

Sample Information						Analysis Information								
Location ID	Sample ID	Sample Date	From (ft)	To (ft)	Class	Portable GC	Volatile Organics	Semivolatile Organics	Herbicides	Pesticides	PCBs	Metals	Extraction	Miscellaneous
SK-SB-130	1026209	2/ 6/97	0	2	SB	x	x	x			x	X		x
SK-SB-130	1026210	2/ 6/97	2	4	SB	x								
SK-SB-130	1026211	2/ 6/97	4	6	SB	x								
SK-SB-130	1026212	2/ 6/97	6	8	SB	x	x				x	X		x
SK-SB-130	1026213	2/ 6/97	8	10	SB	x								
SK-SB-130	1026201	2/ 6/97	9	10	GW			x			x	X		x
SK-SB-130	1026214	2/ 6/97	10	12	SB	x								
SK-SB-130	1026215	2/ 6/97	12	14	SB	x								
SK-SB-130	1026225	2/ 7/97	9.0	11.0	GW		x							
SK-SB-131	1026216	2/ 6/97	0	2	SB	x	x	x			x	X		x
SK-SB-131	1026217	2/ 6/97	0	2	SB	x								
SK-SB-131	1026218	2/ 6/97	2	4	SB	x								
SK-SB-131	1026219	2/ 6/97	4	6	SB	x								
SK-SB-131	1026220	2/ 6/97	6	8	SB	x								
SK-SB-131	1026221	2/ 6/97	8	10	SB	x	x				x	X		x
SK-SB-131	1026202	2/ 6/97	9	10	GW			x			x	x		x
SK-SB-131	1026222	2/ 6/97	10	12	SB	x								
SK-SB-131	1026223	2/ 6/97	12	14	SB	x								
SK-SB-131	1026224	2/ 6/97	14	16	SB	x								
SK-SB-131	1026226	2/ 7/97	9.0	11.0	GW		x							

Notes: 1. Legend: X - Analysed; at least one analyte over the detection limit; x - Analysed, no analytes in group over the detection limit

2. Printed on 05/21/98

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Table 2

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SUMMARY OF SAMPLING AND ANALYTICAL INFORMATION (DETECTS) - SOIL
P&W East Hartford: DEBRIS Pile

	Location ID	SK-SB-130	SK-SB-130	SK-SB-131	SK-SB-131			
	Sample ID	1026209	1026212	1026216	1026221			
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997			
	Sample Time	10:40	11:00	13:15	13:50			
	Sample Depth	0' - 2'	6' - 8'	0' - 2'	8' - 10'			
	Laboratory	AEL	AEL	AEL	AEL			
	Lab. Number	AEL97001964	AEL97001965	AEL97001966	AEL97001967			
Constituent	Units							
Date Metals Analyzed	-	02/19/1997	02/19/1997	02/19/1997	02/19/1997			
Arsenic	mg/kg	1.64	2.06	0.721	0.891			
Barium	mg/kg	27.4	42.8	11	52			
Chromium	mg/kg	14.4	9.31	7.94	8.46			
Zinc	mg/kg	21.6	23.2	15.2	20.7			

Notes: 1. Only Detects Shown

2. Printed on 05/21/98

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Table 3
SUMMARY OF ANALYTICAL RESULTS - SOIL
P&W East Hartford: DEBRIS Pile

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	Location ID	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130
	Sample ID	1026209	1026209	1026210	1026211	1026212	1026212	1026213
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997
	Sample Time	10:40	10:40	10:45	10:55	11:00	11:00	11:15
	Sample Depth	0' - 2'	0' - 2'	2' - 4'	4' - 6'	6' - 8'	6' - 8'	8' - 10'
	Laboratory	AEL	LEA	LEA	LEA	AEL	LEA	LEA
	Lab. Number	AEL97001964	97-1287-139	97-1288-140	97-1289-141	AEL97001965	97-1290-142	97-1291-143
Constituent	Units							
Date Metals Analyzed	-	02/19/1997				02/19/1997		
Date Organics Analyzed	-	02/20/1997	02/10/1997	02/10/1997	02/10/1997	02/20/1997	02/10/1997	02/10/1997
Date PCBs Analyzed	-	02/26/1997				02/26/1997		
Date Semi-volatile Organics Analyzed	-	03/04/1997						
Arsenic	mg/kg	1.64				2.06		
Barium	mg/kg	27.4				42.8		
Cadmium	mg/kg	<3.6				<3.78		
Chromium	mg/kg	14.4				9.31		
Lead	mg/kg	<24				<25.2		
Mercury	mg/kg	<0.0960				<0.101		
Nickel	mg/kg	<12				<12.6		
Selenium	mg/kg	<1.2				<1.26		
Silver	mg/kg	<6.0				<6.29		
Zinc	mg/kg	21.6				23.2		
PCB 1016	µg/kg	<240				<260		
PCB 1221	µg/kg	<240				<260		
PCB 1232	µg/kg	<240				<260		
PCB 1242	µg/kg	<240				<260		
PCB 1248	µg/kg	<240				<260		
PCB 1254	µg/kg	<240				<260		
PCB 1260	µg/kg	<240				<260		
Total Petroleum Hydrocarbons	mg/kg	<39.5				<43.3		
Acenaphthene	µg/kg	<400						
Acenaphthylene	µg/kg	<400						
Anthracene	µg/kg	<400						
Benzidine	µg/kg	<400						
Benzo[a]anthracene	µg/kg	<400						
Benzo[a]pyrene	µg/kg	<400						

Notes: 1. Printed on 05/21/98

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Table 3
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P&W East Hartford: DEBRIS Pile

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	Location ID	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130
	Sample ID	1026209	1026209	1026210	1026211	1026212	1026212	1026213
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997
	Sample Time	10:40	10:40	10:45	10:55	11:00	11:00	11:15
	Sample Depth	0' - 2'	0' - 2'	2' - 4'	4' - 6'	6' - 8'	6' - 8'	8' - 10'
	Laboratory	AEL	LEA	LEA	LEA	AEL	LEA	LEA
	Lab. Number	AEL97001964	97-1287-139	97-1288-140	97-1289-141	AEL97001965	97-1290-142	97-1291-143
Constituent	Units							
Benzo[b]fluoranthene	µg/kg	<400						
Benzo[ghi]perylene	µg/kg	<400						
Benzo[k]fluoranthene	µg/kg	<400						
Bis(2-chloroethoxy)methane	µg/kg	<400						
Bis(2-chloroethyl) Ether	µg/kg	<400						
Bis(2-ethylhexyl)phthalate	µg/kg	<400						
Bromophenyl Phenyl Ether,4-	µg/kg	<400						
Butyl Benzyl Phthalate	µg/kg	<400						
Chloronaphthalene,2-	µg/kg	<400						
Chlorophenol,2-	µg/kg	<400						
Chlorophenyl Phenyl Ether,4-	µg/kg	<400						
Chrysene	µg/kg	<400						
Di-n-butyl Phthalate	µg/kg	<400						
Di-n-octyl Phthalate	µg/kg	<400						
Dibenzo[a,h]anthracene	µg/kg	<400						
Dichlorobenzidine,3,3'-	µg/kg	<400						
Dichlorophenol,2,4-	µg/kg	<400						
Diethyl Phthalate	µg/kg	<400						
Dimethyl Phthalate	µg/kg	<400						
Dimethylphenol,2,4-	µg/kg	<400						
Dinitro-o-cresol,4,6-	µg/kg	<400						
Dinitrophenol,2,4-	µg/kg	<400						
Dinitrotoluene,2,4-	µg/kg	<400						
Dinitrotoluene,2,6-	µg/kg	<400						
Diphenylhydrazine,1,2-	µg/kg	<400						
Fluoranthene	µg/kg	<400						
Fluorene	µg/kg	<400						
Hexachlorobenzene	µg/kg	<400						

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P&W East Hartford: DEBRIS Pile

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	Location ID	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130
	Sample ID	1026209	1026209	1026210	1026211	1026212	1026212	1026213
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997
	Sample Time	10:40	10:40	10:45	10:55	11:00	11:00	11:15
	Sample Depth	0' - 2'	0' - 2'	2' - 4'	4' - 6'	6' - 8'	6' - 8'	8' - 10'
	Laboratory	AEL	LEA	LEA	LEA	AEL	LEA	LEA
	Lab. Number	AEL97001964	97-1287-139	97-1288-140	97-1289-141	AEL97001965	97-1290-142	97-1291-143
Constituent	Units							
Hexachlorobutadiene	µg/kg	<400						
Hexachlorocyclopentadiene	µg/kg	<400						
Hexachloroethane	µg/kg	<400						
Indeno(1,2,3-cd)pyrene	µg/kg	<400						
Isophorone	µg/kg	<400						
N-nitroso-n-propylamine	µg/kg	<400						
N-nitrosodimethylamine	µg/kg	<400						
N-nitrosodiphenylamine	µg/kg	<400						
Naphthalene	µg/kg	<400						
Nitrobenzene	µg/kg	<400						
Nitrophenol,2-	µg/kg	<400						
Nitrophenol,4-	µg/kg	<400						
Pentachlorophenol	µg/kg	<400						
Phenanthrene	µg/kg	<400						
Phenol	µg/kg	<400						
Propane),2,2'-oxybis(2-chloro-	µg/kg	<400						
Pyrene	µg/kg	<400						
Trichlorobenzene,1,2,4-	µg/kg	<400						
Trichlorophenol,2,4,6-	µg/kg	<400						
Acetone	µg/kg	<86				<73		
Acrolein	µg/kg	<39				<24		
Acrylonitrile	µg/kg	<39				<24		
Benzene	µg/kg	<16				<9.8		
Benzene (screening)	µg/kg		<8	<8	<8		<8	<8
Bromobenzene	µg/kg	<16				<9.8		
Bromoform	µg/kg	<16				<9.8		
Carbon Disulfide	µg/kg	<16				<9.8		
Carbon Tetrachloride	µg/kg	<16				<9.8		

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P&W East Hartford: DEBRIS Pile

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	Location ID	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130
	Sample ID	1026209	1026209	1026210	1026211	1026212	1026212	1026213
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997
	Sample Time	10:40	10:40	10:45	10:55	11:00	11:00	11:15
	Sample Depth	0' - 2'	0' - 2'	2' - 4'	4' - 6'	6' - 8'	6' - 8'	8' - 10'
	Laboratory	AEL	LEA	LEA	LEA	AEL	LEA	LEA
	Lab. Number	AEL97001964	97-1287-139	97-1288-140	97-1289-141	AEL97001965	97-1290-142	97-1291-143
Constituent	Units							
Chlorobenzene	µg/kg	<16				<9.8		
Chlorodibromomethane	µg/kg	<16				<9.8		
Chloroethane	µg/kg	<16				<9.8		
Chloroethyl Vinyl Ether,2-	µg/kg	<16				<9.8		
Chloroform	µg/kg	<16				<9.8		
Chlorotoluene,o-	µg/kg	<16				<9.8		
Chlorotoluene,p-	µg/kg	<16				<9.8		
Dibromomethane	µg/kg	<16				<9.8		
Dichlorobenzene,1,2-	µg/kg	<16				<9.8		
Dichlorobenzene,1,3-	µg/kg	<16				<9.8		
Dichlorobenzene,1,4-	µg/kg	<16				<9.8		
Dichlorobromomethane	µg/kg	<16				<9.8		
Dichlorodifluoromethane	µg/kg	<16				<9.8		
Dichloroethane,1,1-	µg/kg	<16				<9.8		
Dichloroethane,1,2-	µg/kg	<16				<9.8		
Dichloroethylene,1,1-	µg/kg	<16				<9.8		
Dichloroethylene,1,2-cis-	µg/kg	<16				<9.8		
Dichloroethylene,1,2-trans-	µg/kg	<16				<9.8		
Dichloropropane,1,2-	µg/kg	<16				<9.8		
Dichloropropylene,1,3-cis-	µg/kg	<16				<9.8		
Dichloropropylene,1,3-trans-	µg/kg	<16				<9.8		
Ethylbenzene	µg/kg	<16				<9.8		
Ethylbenzene (screening)	µg/kg		<17	<17	<17		<17	<17
Hexanone,2-	µg/kg	<39				<24		
Methyl Bromide	µg/kg	<16				<9.8		
Methyl Chloride	µg/kg	<16				<9.8		
Methyl Ethyl Ketone	µg/kg	<39				<24		
Methyl-2-pentanone,4-	µg/kg	<39				<24		

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Table 3
SUMMARY OF ANALYTICAL RESULTS - SOIL
P&W East Hartford: DEBRIS Pile

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	Location ID	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130	SK-SB-130
	Sample ID	1026209	1026209	1026210	1026211	1026212	1026212	1026213
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997
	Sample Time	10:40	10:40	10:45	10:55	11:00	11:00	11:15
	Sample Depth	0' - 2'	0' - 2'	2' - 4'	4' - 6'	6' - 8'	6' - 8'	8' - 10'
	Laboratory	AEL	LEA	LEA	LEA	AEL	LEA	LEA
	Lab. Number	AEL97001964	97-1287-139	97-1288-140	97-1289-141	AEL97001965	97-1290-142	97-1291-143
Constituent	Units							
Methyl-tert-butyl Ether	µg/kg	<16				<9.8		
Methylene Chloride	µg/kg	<35				<27		
Styrene	µg/kg	<16				<9.8		
Tetrachloroethane,1,1,1,2-	µg/kg	<16				<9.8		
Tetrachloroethane,1,1,2,2-	µg/kg	<16				<9.8		
Tetrachloroethylene	µg/kg	<16				<9.8		
Tetrachloroethylene (screening)	µg/kg		<21	<22	<22		<21	<22
Toluene	µg/kg	<16				<9.8		
Toluene (screening)	µg/kg		<12	<12	<12		<12	<12
Trichloroethane,1,1,1-	µg/kg	<16				<9.8		
Trichloroethane,1,1,1- (screening)	µg/kg		<211	<215	<215		<211	<219
Trichloroethane,1,1,2-	µg/kg	<16				<9.8		
Trichloroethylene	µg/kg	<16				<9.8		
Trichloroethylene (screening)	µg/kg		<21	<21	<21		<21	<22
Trichloromonofluoromethane	µg/kg	<16				<9.8		
Trichloropropane,1,2,3-	µg/kg	<16				<9.8		
Vinyl Acetate	µg/kg	<16				<9.8		
Vinyl Chloride	µg/kg	<16				<9.8		
Xylene,o- (screening)	µg/kg		<22	<23	<23		<22	<23
Xylenes (Total)	µg/kg	<16				<9.8		
Xylenes,m- & p- (screening)	µg/kg		<11	<11	<11		<11	<12

Notes: 1. Printed on 05/21/98

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Table 3
SUMMARY OF ANALYTICAL RESULTS - SOIL
P&W East Hartford: DEBRIS Pile

DRAFT

	Location ID	SK-SB-130	SK-SB-130	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131
	Sample ID	1026214	1026215	1026216	1026216	1026217	1026218	1026219
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997
	Sample Time	11:17	11:30	13:15	13:15	13:25	13:30	13:35
	Sample Depth	10' - 12'	12' - 14'	0' - 2'	0' - 2'	0' - 2'	2' - 4'	4' - 6'
	Laboratory	LEA	LEA	AEL	LEA	LEA	LEA	LEA
	Lab. Number	97-1292-144	97-1294-146	AEL97001966	97-1295-147	97-1296-148	97-1297-149	97-1298-150
Constituent	Units							
Date Metals Analyzed	-			02/19/1997				
Date Organics Analyzed	-	02/10/1997	02/10/1997	02/20/1997	02/10/1997	02/10/1997	02/10/1997	02/10/1997
Date PCBs Analyzed	-			02/26/1997				
Date Semi-volatile Organics Analyzed	-			03/06/1997				
Arsenic	mg/kg			0.721				
Barium	mg/kg			11				
Cadmium	mg/kg			<3.61				
Chromium	mg/kg			7.94				
Lead	mg/kg			<24.1				
Mercury	mg/kg			<0.10				
Nickel	mg/kg			<12				
Selenium	mg/kg			<1.2				
Silver	mg/kg			<6.02				
Zinc	mg/kg			15.2				
PCB 1016	µg/kg			<240				
PCB 1221	µg/kg			<240				
PCB 1232	µg/kg			<240				
PCB 1242	µg/kg			<240				
PCB 1248	µg/kg			<240				
PCB 1254	µg/kg			<240				
PCB 1260	µg/kg			<240				
Total Petroleum Hydrocarbons	mg/kg			<48.0				
Acenaphthene	µg/kg			<400				
Acenaphthylene	µg/kg			<400				
Anthracene	µg/kg			<400				
Benzidine	µg/kg			<400				
Benzo[a]anthracene	µg/kg			<400				
Benzo[a]pyrene	µg/kg			<400				

Notes: 1. Printed on 05/21/98

LEA

Table 3
SUMMARY OF ANALYTICAL RESULTS - SOIL
P&W East Hartford: DEBRIS Pile

DRAFT

	Location ID	SK-SB-130	SK-SB-130	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131
	Sample ID	1026214	1026215	1026216	1026216	1026217	1026218	1026219
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997
	Sample Time	11:17	11:30	13:15	13:15	13:25	13:30	13:35
	Sample Depth	10' - 12'	12' - 14'	0' - 2'	0' - 2'	0' - 2'	2' - 4'	4' - 6'
	Laboratory	LEA	LEA	AEL	LEA	LEA	LEA	LEA
	Lab. Number	97-1292-144	97-1294-146	AEL97001966	97-1295-147	97-1296-148	97-1297-149	97-1298-150
Constituent	Units							
Benzo[b]fluoranthene	µg/kg			<400				
Benzo[ghi]perylene	µg/kg			<400				
Benzo[k]fluoranthene	µg/kg			<400				
Bis(2-chloroethoxy)methane	µg/kg			<400				
Bis(2-chloroethyl) Ether	µg/kg			<400				
Bis(2-ethylhexyl)phthalate	µg/kg			<400				
Bromophenyl Phenyl Ether,4-	µg/kg			<400				
Butyl Benzyl Phthalate	µg/kg			<400				
Chloronaphthalene,2-	µg/kg			<400				
Chlorophenol,2-	µg/kg			<400				
Chlorophenyl Phenyl Ether,4-	µg/kg			<400				
Chrysene	µg/kg			<400				
Di-n-butyl Phthalate	µg/kg			<400				
Di-n-octyl Phthalate	µg/kg			<400				
Dibenzo[a,h]anthracene	µg/kg			<400				
Dichlorobenzidine,3,3'-	µg/kg			<400				
Dichlorophenol,2,4-	µg/kg			<400				
Diethyl Phthalate	µg/kg			<400				
Dimethyl Phthalate	µg/kg			<400				
Dimethylphenol,2,4-	µg/kg			<400				
Dinitro-o-cresol,4,6-	µg/kg			<400				
Dinitrophenol,2,4-	µg/kg			<400				
Dinitrotoluene,2,4-	µg/kg			<400				
Dinitrotoluene,2,6-	µg/kg			<400				
Diphenylhydrazine,1,2-	µg/kg			<400				
Fluoranthene	µg/kg			<400 N1				
Fluorene	µg/kg			<400				
Hexachlorobenzene	µg/kg			<400				

Notes: 1. Printed on 05/21/98

LEA

Table 3
SUMMARY OF ANALYTICAL RESULTS - SOIL
P&W East Hartford: DEBRIS Pile

DRAFT

	Location ID	SK-SB-130	SK-SB-130	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131
	Sample ID	1026214	1026215	1026216	1026216	1026217	1026218	1026219
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997
	Sample Time	11:17	11:30	13:15	13:15	13:25	13:30	13:35
	Sample Depth	10' - 12'	12' - 14'	0' - 2'	0' - 2'	0' - 2'	2' - 4'	4' - 6'
	Laboratory	LEA	LEA	AEL	LEA	LEA	LEA	LEA
	Lab. Number	97-1292-144	97-1294-146	AEL97001966	97-1295-147	97-1296-148	97-1297-149	97-1298-150
Constituent	Units							
Hexachlorobutadiene	µg/kg			<400				
Hexachlorocyclopentadiene	µg/kg			<400				
Hexachloroethane	µg/kg			<400				
Indeno(1,2,3-cd)pyrene	µg/kg			<400				
Isophorone	µg/kg			<400				
N-nitroso-n-propylamine	µg/kg			<400				
N-nitrosodimethylamine	µg/kg			<400				
N-nitrosodiphenylamine	µg/kg			<400				
Naphthalene	µg/kg			<400				
Nitrobenzene	µg/kg			<400				
Nitrophenol,2-	µg/kg			<400				
Nitrophenol,4-	µg/kg			<400				
Pentachlorophenol	µg/kg			<400				
Phenanthrene	µg/kg			<400				
Phenol	µg/kg			<400				
Propane),2,2'-oxybis(2-chloro-	µg/kg			<400				
Pyrene	µg/kg			<400				
Trichlorobenzene,1,2,4-	µg/kg			<400				
Trichlorophenol,2,4,6-	µg/kg			<400				
Acetone	µg/kg			<35				
Acrolein	µg/kg			<17				
Acrylonitrile	µg/kg			<17				
Benzene	µg/kg			<6.9				
Benzene (screening)	µg/kg	<8	<8		<8	<8	<8	<8
Bromobenzene	µg/kg			<6.9				
Bromoform	µg/kg			<6.9				
Carbon Disulfide	µg/kg			<6.9				
Carbon Tetrachloride	µg/kg			<6.9				

Notes: 1. Printed on 05/21/98

LEA

Table 3
SUMMARY OF ANALYTICAL RESULTS - SOIL
P&W East Hartford: DEBRIS Pile

DRAFT

	Location ID	SK-SB-130	SK-SB-130	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131
	Sample ID	1026214	1026215	1026216	1026216	1026217	1026218	1026219
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997
	Sample Time	11:17	11:30	13:15	13:15	13:25	13:30	13:35
	Sample Depth	10' - 12'	12' - 14'	0' - 2'	0' - 2'	0' - 2'	2' - 4'	4' - 6'
	Laboratory	LEA	LEA	AEL	LEA	LEA	LEA	LEA
	Lab. Number	97-1292-144	97-1294-146	AEL97001966	97-1295-147	97-1296-148	97-1297-149	97-1298-150
Constituent	Units							
Chlorobenzene	µg/kg			<6.9				
Chlorodibromomethane	µg/kg			<6.9				
Chloroethane	µg/kg			<6.9				
Chloroethyl Vinyl Ether,2-	µg/kg			<6.9				
Chloroform	µg/kg			<6.9				
Chlorotoluene,o-	µg/kg			<6.9				
Chlorotoluene,p-	µg/kg			<6.9				
Dibromomethane	µg/kg			<6.9				
Dichlorobenzene,1,2-	µg/kg			<6.9				
Dichlorobenzene,1,3-	µg/kg			<6.9				
Dichlorobenzene,1,4-	µg/kg			<6.9				
Dichlorobromomethane	µg/kg			<6.9				
Dichlorodifluoromethane	µg/kg			<6.9				
Dichloroethane,1,1-	µg/kg			<6.9				
Dichloroethane,1,2-	µg/kg			<6.9				
Dichloroethylene,1,1-	µg/kg			<6.9				
Dichloroethylene,1,2-cis-	µg/kg			<6.9				
Dichloroethylene,1,2-trans-	µg/kg			<6.9				
Dichloropropane,1,2-	µg/kg			<6.9				
Dichloropropylene,1,3-cis-	µg/kg			<6.9				
Dichloropropylene,1,3-trans-	µg/kg			<6.9				
Ethylbenzene	µg/kg			<6.9				
Ethylbenzene (screening)	µg/kg	<17	<17		<17	<17	<18	<17
Hexanone,2-	µg/kg			<17				
Methyl Bromide	µg/kg			<6.9				
Methyl Chloride	µg/kg			<6.9				
Methyl Ethyl Ketone	µg/kg			<17				
Methyl-2-pentanone,4-	µg/kg			<17				

Notes: 1. Printed on 05/21/98

LEA

Table 3
SUMMARY OF ANALYTICAL RESULTS - SOIL
P&W East Hartford: DEBRIS Pile

DRAFT

	Location ID	SK-SB-130	SK-SB-130	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131
	Sample ID	1026214	1026215	1026216	1026216	1026217	1026218	1026219
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997
	Sample Time	11:17	11:30	13:15	13:15	13:25	13:30	13:35
	Sample Depth	10' - 12'	12' - 14'	0' - 2'	0' - 2'	0' - 2'	2' - 4'	4' - 6'
	Laboratory	LEA	LEA	AEL	LEA	LEA	LEA	LEA
	Lab. Number	97-1292-144	97-1294-146	AEL97001966	97-1295-147	97-1296-148	97-1297-149	97-1298-150
Constituent	Units							
Methyl-tert-butyl Ether	µg/kg			<6.9				
Methylene Chloride	µg/kg			<17				
Styrene	µg/kg			<6.9				
Tetrachloroethane,1,1,1,2-	µg/kg			<6.9				
Tetrachloroethane,1,1,2,2-	µg/kg			<6.9				
Tetrachloroethylene	µg/kg			<6.9				
Tetrachloroethylene (screening)	µg/kg	<22	<22		<21	<22	<22	<22
Toluene	µg/kg			<6.9				
Toluene (screening)	µg/kg	<12	<12		<12	<12	<13	<12
Trichloroethane,1,1,1-	µg/kg			<6.9				
Trichloroethane,1,1,1- (screening)	µg/kg	<219	<215		<211	<215	<224	<219
Trichloroethane,1,1,2-	µg/kg			<6.9				
Trichloroethylene	µg/kg			<6.9				
Trichloroethylene (screening)	µg/kg	<22	<21		<21	<21	<22	<22
Trichloromonofluoromethane	µg/kg			<6.9				
Trichloropropane,1,2,3-	µg/kg			<6.9				
Vinyl Acetate	µg/kg			<6.9				
Vinyl Chloride	µg/kg			<6.9				
Xylene,o- (screening)	µg/kg	<23	<23		<22	<23	<24	<23
Xylenes (Total)	µg/kg			<6.9				
Xylenes,m- & p- (screening)	µg/kg	<12	<11		<11	<11	<12	<12

Notes: 1. Printed on 05/21/98

LEA

Table 3
SUMMARY OF ANALYTICAL RESULTS - SOIL
P&W East Hartford: DEBRIS Pile

DRAFT

	Location ID	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	
	Sample ID	1026220	1026221	1026221	1026222	1026223	1026224	
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	
	Sample Time	13:45	13:50	13:50	13:55	14:00	14:05	
	Sample Depth	6' - 8'	8' - 10'	8' - 10'	10' - 12'	12' - 14'	14' - 16'	
	Laboratory	LEA	AEL	LEA	LEA	LEA	LEA	
	Lab. Number	97-1299-151	AEL97001967	97-1300-152	97-1302-154	97-1303-155	97-1301-153	
Constituent	Units							
Date Metals Analyzed	-		02/19/1997					
Date Organics Analyzed	-	02/10/1997	02/20/1997	02/10/1997	02/10/1997	02/10/1997	02/10/1997	
Date PCBs Analyzed	-		02/26/1997					
Date Semi-volatile Organics Analyzed	-							
Arsenic	mg/kg		0.891					
Barium	mg/kg		52					
Cadmium	mg/kg		<3.68					
Chromium	mg/kg		8.46					
Lead	mg/kg		<24.5					
Mercury	mg/kg		<0.10					
Nickel	mg/kg		<12.3					
Selenium	mg/kg		<1.23					
Silver	mg/kg		<6.13					
Zinc	mg/kg		20.7					
PCB 1016	µg/kg		<240					
PCB 1221	µg/kg		<240					
PCB 1232	µg/kg		<240					
PCB 1242	µg/kg		<240					
PCB 1248	µg/kg		<240					
PCB 1254	µg/kg		<240					
PCB 1260	µg/kg		<240					
Total Petroleum Hydrocarbons	mg/kg		<43.2					
Acenaphthene	µg/kg							
Acenaphthylene	µg/kg							
Anthracene	µg/kg							
Benzidine	µg/kg							
Benzo[a]anthracene	µg/kg							
Benzo[a]pyrene	µg/kg							

Notes: 1. Printed on 05/21/98

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Table 3
SUMMARY OF ANALYTICAL RESULTS - SOIL
P&W East Hartford: DEBRIS Pile

DRAFT

	Location ID	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	
	Sample ID	1026220	1026221	1026221	1026222	1026223	1026224	
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	
	Sample Time	13:45	13:50	13:50	13:55	14:00	14:05	
	Sample Depth	6' - 8'	8' - 10'	8' - 10'	10' - 12'	12' - 14'	14' - 16'	
	Laboratory	LEA	AEL	LEA	LEA	LEA	LEA	
	Lab. Number	97-1299-151	AEL97001967	97-1300-152	97-1302-154	97-1303-155	97-1301-153	
Constituent	Units							
Benzo[b]fluoranthene	µg/kg							
Benzo[ghi]perylene	µg/kg							
Benzo[k]fluoranthene	µg/kg							
Bis(2-chloroethoxy)methane	µg/kg							
Bis(2-chloroethyl) Ether	µg/kg							
Bis(2-ethylhexyl)phthalate	µg/kg							
Bromophenyl Phenyl Ether,4-	µg/kg							
Butyl Benzyl Phthalate	µg/kg							
Chloronaphthalene,2-	µg/kg							
Chlorophenol,2-	µg/kg							
Chlorophenyl Phenyl Ether,4-	µg/kg							
Chrysene	µg/kg							
Di-n-butyl Phthalate	µg/kg							
Di-n-octyl Phthalate	µg/kg							
Dibenzo[a,h]anthracene	µg/kg							
Dichlorobenzidine,3,3'-	µg/kg							
Dichlorophenol,2,4-	µg/kg							
Diethyl Phthalate	µg/kg							
Dimethyl Phthalate	µg/kg							
Dimethylphenol,2,4-	µg/kg							
Dinitro-o-cresol,4,6-	µg/kg							
Dinitrophenol,2,4-	µg/kg							
Dinitrotoluene,2,4-	µg/kg							
Dinitrotoluene,2,6-	µg/kg							
Diphenylhydrazine,1,2-	µg/kg							
Fluoranthene	µg/kg							
Fluorene	µg/kg							
Hexachlorobenzene	µg/kg							

Notes: 1. Printed on 05/21/98

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Table 3
SUMMARY OF ANALYTICAL RESULTS - SOIL
P&W East Hartford: DEBRIS Pile

DRAFT

	Location ID	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	
	Sample ID	1026220	1026221	1026221	1026222	1026223	1026224	
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	
	Sample Time	13:45	13:50	13:50	13:55	14:00	14:05	
	Sample Depth	6' - 8'	8' - 10'	8' - 10'	10' - 12'	12' - 14'	14' - 16'	
	Laboratory	LEA	AEL	LEA	LEA	LEA	LEA	
	Lab. Number	97-1299-151	AEL97001967	97-1300-152	97-1302-154	97-1303-155	97-1301-153	
Constituent	Units							
Hexachlorobutadiene	µg/kg							
Hexachlorocyclopentadiene	µg/kg							
Hexachloroethane	µg/kg							
Indeno(1,2,3-cd)pyrene	µg/kg							
Isophorone	µg/kg							
N-nitroso-n-propylamine	µg/kg							
N-nitrosodimethylamine	µg/kg							
N-nitrosodiphenylamine	µg/kg							
Naphthalene	µg/kg							
Nitrobenzene	µg/kg							
Nitrophenol,2-	µg/kg							
Nitrophenol,4-	µg/kg							
Pentachlorophenol	µg/kg							
Phenanthrene	µg/kg							
Phenol	µg/kg							
Propane),2,2'-oxybis(2-chloro-	µg/kg							
Pyrene	µg/kg							
Trichlorobenzene,1,2,4-	µg/kg							
Trichlorophenol,2,4,6-	µg/kg							
Acetone	µg/kg		<43					
Acrolein	µg/kg		<21					
Acrylonitrile	µg/kg		<21					
Benzene	µg/kg		<8.5					
Benzene (screening)	µg/kg	<8		<8	<8	<8	<8	
Bromobenzene	µg/kg		<8.5					
Bromoform	µg/kg		<8.5					
Carbon Disulfide	µg/kg		<8.5					
Carbon Tetrachloride	µg/kg		<8.5					

Notes: 1. Printed on 05/21/98

LEA

Table 3
SUMMARY OF ANALYTICAL RESULTS - SOIL
P&W East Hartford: DEBRIS Pile

DRAFT

	Location ID	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	
	Sample ID	1026220	1026221	1026221	1026222	1026223	1026224	
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	
	Sample Time	13:45	13:50	13:50	13:55	14:00	14:05	
	Sample Depth	6' - 8'	8' - 10'	8' - 10'	10' - 12'	12' - 14'	14' - 16'	
	Laboratory	LEA	AEL	LEA	LEA	LEA	LEA	
	Lab. Number	97-1299-151	AEL97001967	97-1300-152	97-1302-154	97-1303-155	97-1301-153	
Constituent	Units							
Chlorobenzene	µg/kg		<8.5					
Chlorodibromomethane	µg/kg		<8.5					
Chloroethane	µg/kg		<8.5					
Chloroethyl Vinyl Ether,2-	µg/kg		<8.5					
Chloroform	µg/kg		<8.5					
Chlorotoluene,o-	µg/kg		<8.5					
Chlorotoluene,p-	µg/kg		<8.5					
Dibromomethane	µg/kg		<8.5					
Dichlorobenzene,1,2-	µg/kg		<8.5					
Dichlorobenzene,1,3-	µg/kg		<8.5					
Dichlorobenzene,1,4-	µg/kg		<8.5					
Dichlorobromomethane	µg/kg		<8.5					
Dichlorodifluoromethane	µg/kg		<8.5					
Dichloroethane,1,1-	µg/kg		<8.5					
Dichloroethane,1,2-	µg/kg		<8.5					
Dichloroethylene,1,1-	µg/kg		<8.5					
Dichloroethylene,1,2-cis-	µg/kg		<8.5					
Dichloroethylene,1,2-trans-	µg/kg		<8.5					
Dichloropropane,1,2-	µg/kg		<8.5					
Dichloropropylene,1,3-cis-	µg/kg		<8.5					
Dichloropropylene,1,3-trans-	µg/kg		<8.5					
Ethylbenzene	µg/kg		<8.5					
Ethylbenzene (screening)	µg/kg	<17		<16	<17	<17	<17	
Hexanone,2-	µg/kg		<21					
Methyl Bromide	µg/kg		<8.5					
Methyl Chloride	µg/kg		<8.5					
Methyl Ethyl Ketone	µg/kg		<21					
Methyl-2-pentanone,4-	µg/kg		<21					

Notes: 1. Printed on 05/21/98

LEA

Table 3
SUMMARY OF ANALYTICAL RESULTS - SOIL
P&W East Hartford: DEBRIS Pile

DRAFT

	Location ID	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	SK-SB-131	
	Sample ID	1026220	1026221	1026221	1026222	1026223	1026224	
	Sample Date	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	02/06/1997	
	Sample Time	13:45	13:50	13:50	13:55	14:00	14:05	
	Sample Depth	6' - 8'	8' - 10'	8' - 10'	10' - 12'	12' - 14'	14' - 16'	
	Laboratory	LEA	AEL	LEA	LEA	LEA	LEA	
	Lab. Number	97-1299-151	AEL97001967	97-1300-152	97-1302-154	97-1303-155	97-1301-153	
Constituent	Units							
Methyl-tert-butyl Ether	µg/kg		<8.5					
Methylene Chloride	µg/kg		<23					
Styrene	µg/kg		<8.5					
Tetrachloroethane,1,1,1,2-	µg/kg		<8.5					
Tetrachloroethane,1,1,2,2-	µg/kg		<8.5					
Tetrachloroethylene	µg/kg		<8.5					
Tetrachloroethylene (screening)	µg/kg	<21		<21	<21	<21	<22	
Toluene	µg/kg		<8.5					
Toluene (screening)	µg/kg	<12		<12	<12	<12	<12	
Trichloroethane,1,1,1-	µg/kg		<8.5					
Trichloroethane,1,1,1- (screening)	µg/kg	<211		<207	<211	<211	<219	
Trichloroethane,1,1,2-	µg/kg		<8.5					
Trichloroethylene	µg/kg		<8.5					
Trichloroethylene (screening)	µg/kg	<21		<20	<21	<21	<22	
Trichloromonofluoromethane	µg/kg		<8.5					
Trichloropropane,1,2,3-	µg/kg		<8.5					
Vinyl Acetate	µg/kg		<8.5					
Vinyl Chloride	µg/kg		<8.5					
Xylene,o- (screening)	µg/kg	<22		<22	<22	<22	<23	
Xylenes (Total)	µg/kg		<8.5					
Xylenes,m- & p- (screening)	µg/kg	<11		<11	<11	<11	<12	

Notes: 1. Printed on 05/21/98

LEA

Table 4 *DRAFT*

SUMMARY OF SAMPLING AND ANALYTICAL INFORMATION (DETECTS) - GROUNDWATER

P&W East Hartford: DEBRIS Pile

	Location ID	SK-SB-130						
	Sample ID	1026201						
	Sample Date	02/06/1997						
	Sample Time	12:10						
	Sample Depth	9' - 10'						
	Laboratory	AEL						
	Lab. Number	AEL97001658						
Constituent	Units							
Depth to Water	FT	8.5						
Date Metals Analyzed	-	02/13/1997						
Barium	mg/L	0.167						
Mercury	mg/L	0.0005						

Notes: 1. Only Detects Shown

2. Printed on 05/21/98

LEA

Table 5

DRAFT

SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
P&W East Hartford: DEBRIS Pile

	Location ID	SK-SB-130	SK-SB-130	SK-SB-131	SK-SB-131			
	Sample ID	1026201	1026225	1026202	1026226			
	Sample Date	02/06/1997	02/07/1997	02/06/1997	02/07/1997			
	Sample Time	12:10	11:55	15:00	14:10			
	Sample Depth	9' - 10'	9.0' - 11.0'	9' - 10'	9.0' - 11.0'			
	Laboratory	AEL	AEL	AEL	AEL			
	Lab. Number	AEL97001658	AEL97001701	AEL97001659	AEL97001702			
Constituent	Units							
Depth to Water	FT	8.5						
Date Metals Analyzed	-	02/13/1997		02/13/1997				
Date Organics Analyzed	-		02/19/1997		02/19/1997			
Date PCBs Analyzed	-	02/26/1997		02/26/1997				
Date Semi-volatile Organics Analyzed	-	02/22/1997		02/22/1997				
Arsenic	mg/L	<0.004		<0.004				
Barium	mg/L	0.167		<0.050				
Cadmium	mg/L	<0.0010		<0.0010				
Chromium	mg/L	<0.050		<0.050				
Copper	mg/L	<0.040		<0.040				
Lead	mg/L	<0.0050		<0.0050				
Mercury	mg/L	0.0005		<0.0004				
Nickel	mg/L	<0.10		<0.10				
Selenium	mg/L	<0.010		<0.010				
Silver	mg/L	<0.027		<0.027				
Zinc	mg/L	<0.050		<0.050				
PCB 1016	µg/L	<1.0		<0.50				
PCB 1221	µg/L	<1.0		<0.50				
PCB 1232	µg/L	<1.0		<0.50				
PCB 1242	µg/L	<1.0		<0.50				
PCB 1248	µg/L	<1.0		<0.50				
PCB 1254	µg/L	<1.0		<0.20				
PCB 1260	µg/L	<1.0		<0.20				
Total Petroleum Hydrocarbons	mg/L	<0.5		<0.5				
Acenaphthene	µg/L	<11		<10				
Acenaphthylene	µg/L	<1.7 MDL		<1.6 MDL				
Anthracene	µg/L	<11		<10				
Benzidine	µg/L	<11		<10				

Notes: 1. Printed on 05/21/98

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Table 5

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
P&W East Hartford: DEBRIS Pile

	Location ID	SK-SB-130	SK-SB-130	SK-SB-131	SK-SB-131			
	Sample ID	1026201	1026225	1026202	1026226			
	Sample Date	02/06/1997	02/07/1997	02/06/1997	02/07/1997			
	Sample Time	12:10	11:55	15:00	14:10			
	Sample Depth	9' - 10'	9.0' - 11.0'	9' - 10'	9.0' - 11.0'			
	Laboratory	AEL	AEL	AEL	AEL			
	Lab. Number	AEL97001658	AEL97001701	AEL97001659	AEL97001702			
Constituent	Units							
Benzo[a]anthracene	µg/L	<0.86 MDL		<0.82 MDL				
Benzo[a]pyrene	µg/L	<0.39 MDL		<0.37 MDL				
Benzo[b]fluoranthene	µg/L	<0.53 MDL		<0.51 MDL				
Benzo[ghi]perylene	µg/L	<11		<10				
Benzo[k]fluoranthene	µg/L	<0.63 MDL		<0.60 MDL				
Bis(2-chloroethoxy)methane	µg/L	<11		<10				
Bis(2-chloroethyl) Ether	µg/L	<11		<10				
Bis(2-ethylhexyl)phthalate	µg/L	<3.6 U		<1.3 MDL				
Bromophenyl Phenyl Ether,4-	µg/L	<11		<10				
Butyl Benzyl Phthalate	µg/L	<11		<10				
Chloronaphthalene,2-	µg/L	<11		<10				
Chlorophenol,2-	µg/L	<11		<10				
Chlorophenyl Phenyl Ether,4-	µg/L	<11		<10				
Chrysene	µg/L	<11		<10				
Di-n-butyl Phthalate	µg/L	<11		<10				
Di-n-octyl Phthalate	µg/L	<11		<10				
Dibenzo[a,h]anthracene	µg/L	<11		<10				
Dichlorobenzidine,3,3'-	µg/L	<11		<10				
Dichlorophenol,2,4-	µg/L	<11		<10				
Diethyl Phthalate	µg/L	<11		<10				
Dimethyl Phthalate	µg/L	<11		<10				
Dimethylphenol,2,4-	µg/L	<11		<10				
Dinitro-o-cresol,4,6-	µg/L	<11		<10				
Dinitrophenol,2,4-	µg/L	<11		<10				
Dinitrotoluene,2,4-	µg/L	<11		<10				
Dinitrotoluene,2,6-	µg/L	<11		<10				
Diphenylhydrazine,1,2-	µg/L	<11		<10				
Fluoranthene	µg/L	<11		<10				

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
P&W East Hartford: DEBRIS Pile

	Location ID	SK-SB-130	SK-SB-130	SK-SB-131	SK-SB-131			
	Sample ID	1026201	1026225	1026202	1026226			
	Sample Date	02/06/1997	02/07/1997	02/06/1997	02/07/1997			
	Sample Time	*12:10*	*11:55*	*15:00*	*14:10*			
	Sample Depth	9' - 10'	9.0' - 11.0'	9' - 10'	9.0' - 11.0'			
	Laboratory	AEL	AEL	AEL	AEL			
	Lab. Number	AEL97001658	AEL97001701	AEL97001659	AEL97001702			
Constituent	Units							
Fluorene	µg/L	<11		<10				
Hexachlorobenzene	µg/L	<1.3 MDL		<1.2 MDL				
Hexachlorobutadiene	µg/L	<11		<10				
Hexachlorocyclopentadiene	µg/L	<11		<10				
Hexachloroethane	µg/L	<1.3 MDL		<1.2 MDL				
Indeno(1,2,3-cd)pyrene	µg/L	<11		<10				
Isophorone	µg/L	<11		<10				
N-nitroso-n-propylamine	µg/L	<11		<10				
N-nitrosodimethylamine	µg/L	<11		<10				
N-nitrosodiphenylamine	µg/L	<11		<10				
Naphthalene	µg/L	<11		<10				
Nitrobenzene	µg/L	<11		<10				
Nitrophenol,2-	µg/L	<11		<10				
Nitrophenol,4-	µg/L	<11		<10				
Pentachlorophenol	µg/L	<0.66 MDL		<0.63 MDL				
Phenanthrene	µg/L	<1.1 MDL		<1.1 MDL				
Phenol	µg/L	<11		<10				
Propane),2,2'-oxybis(2-chloro-	µg/L	<11		<10				
Pyrene	µg/L	<11		<10				
Trichlorobenzene,1,2,4-	µg/L	<11		<10				
Trichlorophenol,2,4,6-	µg/L	<11		<10				
Acetone	µg/L		<6.0		<4.0			
Acrolein	µg/L		<15		<15			
Acrylonitrile	µg/L		<0.65		<0.65			
Benzene	µg/L		<1.0		<1.0			
Bromobenzene	µg/L		<1.0		<1.0			
Bromoform	µg/L		<1.0		<1.0			
Carbon Disulfide	µg/L		<1.0		<1.0			

Notes: 1. Printed on 05/21/98

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Table 5

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
P&W East Hartford: DEBRIS Pile

	Location ID	SK-SB-130	SK-SB-130	SK-SB-131	SK-SB-131			
	Sample ID	1026201	1026225	1026202	1026226			
	Sample Date	02/06/1997	02/07/1997	02/06/1997	02/07/1997			
	Sample Time	12:10	11:55	15:00	14:10			
	Sample Depth	9' - 10'	9.0' - 11.0'	9' - 10'	9.0' - 11.0'			
	Laboratory	AEL	AEL	AEL	AEL			
	Lab. Number	AEL97001658	AEL97001701	AEL97001659	AEL97001702			
Constituent	Units							
Carbon Tetrachloride	µg/L		<1.0		<1.0			
Chlorobenzene	µg/L		<1.0		<1.0			
Chlorodibromomethane	µg/L		<0.50		<0.50			
Chloroethane	µg/L		<1.0		<1.0			
Chloroethyl Vinyl Ether,2-	µg/L		<1.0		<1.0			
Chloroform	µg/L		<1.0		<1.0			
Chlorotoluene,o-	µg/L		<1.0		<1.0			
Chlorotoluene,p-	µg/L	<11	<1.0	<10	<1.0			
Dibromomethane	µg/L		<1.0		<1.0			
Dichlorobenzene,1,2-	µg/L	<11	<1.0	<10	<1.0			
Dichlorobenzene,1,3-	µg/L	<11	<1.0	<10	<1.0			
Dichlorobenzene,1,4-	µg/L	<11	<1.0	<10	<1.0			
Dichlorobromomethane	µg/L		<1.0		<1.0			
Dichlorodifluoromethane	µg/L		<1.0		<1.0			
Dichloroethane,1,1-	µg/L		<1.0		<1.0			
Dichloroethane,1,2-	µg/L		<1.0		<1.0			
Dichloroethylene,1,1-	µg/L		<1.0		<1.0			
Dichloroethylene,1,2-cis-	µg/L		<1.0		<1.0			
Dichloroethylene,1,2-trans-	µg/L		<1.0		<1.0			
Dichloropropane,1,2-	µg/L		<1.0		<1.0			
Dichloropropylene,1,3-cis-	µg/L		<0.50		<0.50			
Dichloropropylene,1,3-trans-	µg/L		<0.50		<0.50			
Ethylbenzene	µg/L		<1.0		<1.0			
Hexanone,2-	µg/L		<2.0		<2.0			
Methyl Bromide	µg/L		<1.0		<1.0			
Methyl Chloride	µg/L		<1.0		<1.0			
Methyl Ethyl Ketone	µg/L		<2.0		<2.0			
Methyl-2-pentanone,4-	µg/L		<2.0		<2.0			

Notes: 1. Printed on 05/21/98

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Table 5

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SUMMARY OF ANALYTICAL RESULTS - GROUNDWATER
P&W East Hartford: DEBRIS Pile

	Location ID	SK-SB-130	SK-SB-130	SK-SB-131	SK-SB-131			
	Sample ID	1026201	1026225	1026202	1026226			
	Sample Date	02/06/1997	02/07/1997	02/06/1997	02/07/1997			
	Sample Time	12:10	11:55	15:00	14:10			
	Sample Depth	9' - 10'	9.0' - 11.0'	9' - 10'	9.0' - 11.0'			
	Laboratory	AEL	AEL	AEL	AEL			
	Lab. Number	AEL97001658	AEL97001701	AEL97001659	AEL97001702			
Constituent	Units							
Methyl-tert-butyl Ether	µg/L		<1.0		<1.0			
Methylene Chloride	µg/L		<2.0		<2.0			
Styrene	µg/L		<1.0		<1.0			
Tetrachloroethane,1,1,1,2-	µg/L		<1.0		<1.0			
Tetrachloroethane,1,1,2,2-	µg/L		<0.50		<0.50			
Tetrachloroethylene	µg/L		<1.0		<1.0			
Toluene	µg/L		<1.0		<1.0			
Trichloroethane,1,1,1-	µg/L		<1.0		<1.0			
Trichloroethane,1,1,2-	µg/L		<1.0		<1.0			
Trichloroethylene	µg/L		<1.0		<1.0			
Trichloromonofluoromethane	µg/L		<1.0		<1.0			
Trichloropropane,1,2,3-	µg/L		<1.0		<1.0			
Vinyl Acetate	µg/L		<2.0		<2.0			
Vinyl Chloride	µg/L		<1.0		<1.0			
Xylenes (Total)	µg/L		<1.0		<1.0			

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DRAWING 1: SOIL INVESTIGATIONS SOUTH KLONDIKE DEBRIS PILE, LOCATION & CONSTITUENTS DETECTED MAP

[X] Map [ ] Photograph [ ] Other (Specify Below)

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DRAFT

UNIT-SPECIFIC TECHNICAL MEMORANDUM: SOUTH KLONDIKE AREA UNDEVELOPED LAND

PRATT & WHITNEY, EAST HARTFORD, CT

AREA: South Klondike

SUB-AREA: Undeveloped Land Area

ENVIRONMENTAL UNIT: Undeveloped Land Area

Location: The location for this unit is east of the developed portion of the South Klondike Area (Drawing 1).

Description: The Undeveloped Land Area, consisting of approximately 47 wooded acres, was not developed during the period of Pratt & Whitney (P&W) ownership. Available mapping of the area (Petersen and Hoffman, 1953) indicates the various parcels of land that P&W purchased over the years. These parcels were purchased beginning in the early 1950's.

Dates of Operation: No operations had reportedly been performed in the Undeveloped Land Area within the South Klondike Area during the period of P&W ownership.

Processes: No reported use.

Aerial Photographs: Large-scale aerial photographs for 1965, 1970, and 1975 were obtained from Keystone Aerial Surveys, Inc. A review of the 1965 aerial photograph indicates that the area consisted of mostly trees. One particular feature that can be identified from this photograph is an "L-shaped" mark. Although this mark seems unusual, earlier aerial photographs (Fairchild, 1934) indicate that this particular area appeared to have been cultivated for a different period of time than the surrounding areas. The differences in the period of cultivation resulted in shorter trees and the apparent "L-shaped" marking.

Specific Contaminants of Concern: Since P&W acquired the land, no activities have been conducted at this unit. Therefore, no contaminants are believed to be present.

Potential Release Mechanism: Since no activities have occurred during P&W's ownership, no release mechanism is expected.

INVESTIGATION AND REMEDIATION ACTIVITIES:

Various groundwater investigations have been conducted in the South Klondike Undeveloped Land Area since 1990. In the South Klondike Area, monitoring wells SK-MW-01 through SK-MW-04 were installed in February 1990 during the Preliminary Reconnaissance Survey of the Airport/Klondike Area by Westinghouse Environmental and Geotechnical Services, Inc. (Westinghouse). Wells SK-MW-09 and SK-MW-10 were installed in October 1991 during the Site-Wide Environmental Monitoring Program at the Main Street facility by Haley & Aldrich, Inc. (H&A). The monitoring well locations are shown on Drawing 1.

These monitoring wells were installed as part of the site-wide investigations of groundwater contamination. These wells were installed to provide general information on background and upgradient groundwater quality as well as information about the site stratigraphy. Due to the lack of activity for this unit, soil samples were not collected for laboratory analysis during the installation of these monitoring wells.

Supplemental groundwater investigations have been conducted in the South Klondike Undeveloped Area since the installation of the monitoring wells. In order to be as comprehensive as possible, presentation of this incidental data is discussed as part of this Unit-Specific Technical Memorandum. A summary of the samples collected and analyses performed is included in Table 1.

The groundwater samples for these monitoring wells indicated the presence of a single volatile organic compound (VOC) and total petroleum hydrocarbons (TPH). The presence of TPH and tetrachloroethylene (PCE) were detected in monitoring wells SK-MW-02 and SK-MW-09, respectively. The detection of these constituents were isolated events and were not detected in subsequent sampling events.

One or more of the metals analyzed were detected in the groundwater samples collected and analyzed from every monitoring well. These metals include barium, chromium, lead, and zinc. The concentrations of the metals detected are typical of background concentrations and are not indicative of a release from this unit. For a more detailed account of the groundwater sampling refer to *Technical Memorandum 3, Groundwater Sampling and Quality*. Since this unit has never been developed during P&W's ownership and no releases are expected. Therefore, subsurface soil investigations are not warranted for this unit.

REFERENCES:

Fairchild Aerial Survey, 1934.

Keystone Aerial Surveys, Inc., 1965, *Aerial Photo of Rentschler Airport and Surrounding Areas*, East Hartford, CT.

Petersen and Hoffman Engineers, Revised 1988, *Property of East Hartford Plant*, prepared for Pratt & Whitney.

TABLES

Table 1
SUMMARY OF SAMPLING AND ANALYTICAL INFORMATION
P&W East Hartford: SK Undeveloped Land Area

DRAFT

Sample Information						Analysis Information								
Location ID	Sample ID	Sample Date	From (ft)	To (ft)	Class	Portable GC	Volatile Organics	Semivolatile Organics	Herbicides	Pesticides	PCBs	Metals	Extraction	Miscellaneous
SK-MW-01	CW1900309	3/ 9/90	8.00	13.00	GW		x	x						
SK-MW-01	1018049	9/10/96	8.00	13.00	GW		x				x	x		x
SK-MW-01	1634453	6/ 3/97	8.0	13.0	GW							X		
SK-MW-01	1647368	11/24/97	8.0	13.0	GW							X		
SK-MW-02	CW3900309	3/ 9/90	9.00	19.00	GW		x	x						
SK-MW-02	1018172	9/11/96	9.00	19.00	GW		x				x	X		X
SK-MW-02	1634456	6/ 3/97	9.0	19.0	GW			x				x		x
SK-MW-02	1647371	11/24/97	9	19	GW			x				X		x
SK-MW-03	CW4900309	3/ 9/90	6.00	16.00	GW		x	x						
SK-MW-03	1018173	9/11/96	6.00	16.00	GW		x				x	X		x
SK-MW-03	1634455	6/ 3/97	6.0	16.0	GW							x		
SK-MW-03	1647370	11/24/97	6.0	16.0	GW							X		
SK-MW-04	CW5900309	3/ 9/90	5.60	15.60	GW		x	x						
SK-MW-04	1018174	9/11/96	5.60	15.60	GW		x				x	X		x
SK-MW-04	1634454	6/ 3/97	5.6	15.6	GW							X		
SK-MW-04	1647369	11/24/97	5.6	15.6	GW							x		
SK-MW-09	02091111391	11/14/91	5.00	15.00	GW	x						X		
SK-MW-09	02091060992	6/10/92	5.00	15.00	GW	X						X		
SK-MW-09	1018051	9/10/96	5.00	15.00	GW		x				x	X		x
SK-MW-09	1634450	6/ 3/97	5.0	15.0	GW		x					x		
SK-MW-09	1647354	11/21/97	5.0	15.0	GW		x					x		
SK-MW-10	02101111391	11/14/91	5.00	15.00	GW	x						X		
SK-MW-10	02101060992	6/10/92	5.00	15.00	GW	x						X		
SK-MW-10	1018050	9/10/96	5.00	15.00	GW		x				x	X		x
SK-MW-10	1634451	6/ 3/97	5.0	15.0	GW							X		
SK-MW-10	1634452	6/ 3/97	5.0	15.0	GW							x		
SK-MW-10	1647366	11/24/97	5.0	15.0	GW							X		
SK-MW-10	1647367	11/24/97	5.0	15.0	GW							x		

Notes: 1. Legend: X - Analysed; at least one analyte over the detection limit; x - Analysed, no analytes in group over the detection limit

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DRAWING 1: SOIL INVESTIGATIONS SOUTH KLONDIKE UNDEVELOPED LAND, LOCATION & CONSTITUENTS DETECTED MAP

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DRAWING 9: GROUNDWATER INVESTIGATIONS
SOUTHEAST PORTION, LOCATION &
CONSTITUENTS DETECTED MAP

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DRAWING 6: GROUNDWATER INVESTIGATIONS NORTHWEST PORTION, LOCATION & CONSTITUENTS DETECTED MAP

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Description of Oversized Material, if applicable:

DRAWING 7: GROUNDWATER INVESTIGATIONS
NORTHEAST PORTION, LOCATION &
CONSTITUENTS DETECTED MAP

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Description of Oversized Material, if applicable:

DRAWING 8: GROUNDWATER INVESTIGATIONS SOUTHWEST PORTION, LOCATION & CONSTITUENTS DETECTED MAP

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Description of Oversized Material, if applicable:

DRAWING 1: SUMMARY SITE INVESTIGATION AND REMEDIATION REPORT, GROUNDWATER SAMPLING LOCATION MAP

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DRAWING 4: GROUNDWATER CONTOUR MAP, KLONDIKE AND AIRPORT AREAS, APRIL 1998

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Description of Oversized Material, if applicable:

DRAWING 3: GROUNDWATER CONTOUR MAP, KLONDIKE AND AIRPORT AREAS, NOVEMBER 1997

[X] Map [ ] Photograph [ ] Other (Specify Below)

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Description of Oversized Material, if applicable:

DRAWING 1: METALS, PCBS, SVOCS & TPH EXCEEDANCES OF SWPC IN GROUNDWATER SAMPLING LOCATION MAP

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DRAWING 1: VOC EXCEEDANCES OF SWPC AND IVC
IN GROUNDWATER SAMPLING LOCATION MAP

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DRAWING 1: GROUNDWATER INVESTIGATIONS,
LINDE AREA DRUM & DUMPSTER STORAGE
LOCATION & CONSTITUENTS DETECTED MAP

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LOCATION & CONSTITUENTS DETECTED MAP

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DRAWING 1: GROUNDWATER INVESTIGATIONS, SOUTH KLONDIKE DEBRIS PILE, LOCATION & CONSTITUENTS DETECTED MAP

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DRAWING 1: GROUNDWATER INVESTIGATIONS, SOUTH KLONDIKE UNDEVELOPED LAND, LOCATION & CONSTITUENTS DETECTED MAP

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DRAWING 1: GROUNDWATER INVESTIGATIONS, FORMER FIRING RANGE AREA, LOCATION & CONSTITUENTS DETECTED MAP

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DRAWING 1: SVOC EXCEEDANCES OF SWPC IN GROUNDWATER SAMPLING LOCATION MAP

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SUMMARY
SITE INVESTIGATION AND REMEDIATION REPORT
AIRPORT/KLONDIKE AREA
AT
PRATT & WHITNEY
EAST HARTFORD, CONNECTICUT
EPA ID No. CTD990672081

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LEA Comm. No. 68V8124

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3. INVESTIGATION METHODOLOGIES

The investigative methods and procedures followed to characterize the site environmental setting, to assess the nature and extent of release(s) to soil or groundwater due to activities conducted at the Site, and to support remedial activities are presented in this section. The procedures used to perform soil borings, install monitoring wells, and obtain samples of soil and groundwater for the investigation at Site are summarized below. Specific investigation methodologies are detailed in the individual Technical Memoranda (TM) included in this report.

The field investigation activities were conducted in accordance with the Site Health and Safety Plan prepared for the project. Additional information regarding sample management, documentation requirements, laboratory methods, and analytical quality assurance (QA)/quality control (QC) procedures were presented in the Quality Assurance Manual (QAM) in the Voluntary Corrective Action Program Work Plan.

The following sections provide a brief description of the approach, rationale, and types of investigation activities performed to characterize the environmental setting and to delineate contamination at the Site. Details of the environmental setting investigation activities are presented in Section 3.2 and details of contaminant delineation activities are presented in Section 3.3.

3.1 Overview of Data Gaps

Hydrogeologic conditions at the Site have been studied by others in the past. Monitoring wells and soil borings were installed as part of those investigations. This existing monitoring wells, soil borings, and soil and groundwater quality information has been incorporated into the site hydrogeological conceptual model.

Boring logs, water-level measurements, and water-quality data from existing wells and borings around the Site were reviewed to develop an understanding of site hydrogeology and the relationship between observed groundwater contamination and the locations and types of potential contaminant source areas. The available information indicated that inorganic constituents, semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and volatile organic compounds (VOCs), primarily chlorinated solvents and associated degradation products, were detected in groundwater at the Site. However, the locations of the monitoring wells and the limited number of groundwater samples that had been collected did not provide sufficient information either to develop a complete understanding of the hydrogeology of the

Site, to assess the overall groundwater quality, or to evaluate the relationship between the groundwater quality and any potential contaminant source areas.

Following the evaluation of the existing hydrogeologic and water-quality information, data gaps were identified in several areas of the Site. The investigation activities were intended to bridge these gaps in the hydrogeologic database. Individual monitoring wells consisting of shallow (water table) wells and monitoring well clusters consisting of a shallow monitoring well and a deep or an intermediate monitoring well (as appropriate for the conditions at the Site) were installed for the purpose of defining site-wide hydrogeology. Shallow monitoring wells were installed with screens positioned across the water table for the purpose of determining water-table elevations and groundwater flow directions in the shallow zone of the aquifer, as well as for delineating contamination in specific areas.

3.2 Environmental Setting Investigations

The environmental setting investigation was designed to develop an understanding of soil and groundwater characteristics across the Site, particularly in the context of how those conditions might affect the fate and transport of potential contaminants. The objective was to define site stratigraphy and hydrogeology sufficiently to refine the conceptual hydrogeologic model for the Site. The information obtained was used to evaluate potential contaminant migration pathways and transport mechanisms in order to assess the need for, applicability, and effectiveness of potential remedial technologies.

Protocols and procedures for the completion of the environmental setting investigation tasks were presented in the Standard Operations Procedures (SOPs) included in the Voluntary Corrective Action Program (VCAP) Work Plan and are documented in the appropriate TMs included in this report.

3.2.1 Soils Investigations

The purpose of the soils characterization portion of the environmental setting investigation was to define the stratigraphy and physical properties of the unconsolidated materials in both the saturated and unsaturated zones. The stratigraphy describes the distribution of unconsolidated materials across the Site, with particular emphasis on the characteristics of those materials that affect contaminant migration pathways and transport mechanisms. The physical properties, including permeability, sorptive capacity, density, and grain size, affect contaminant migration and the evaluation, design, and performance of potential remedial measures.

This section describes the specific soil borings and sampling performed in order to define site stratigraphy and soil properties and provide an overview of hydrogeologic conditions across the Site. Soils information was gathered during direct soil sampling and during groundwater monitoring well installation. Soil borings advanced for the purpose of contaminant delineation in the unsaturated zone also served to further refine site stratigraphy and the conceptual hydrogeologic model.

The following information on the unconsolidated deposits was gathered for purposes of the environmental setting investigation:

- Description and stratigraphy of the unconsolidated materials encountered at each monitoring well location.
- Description and stratigraphy at each boring conducted to evaluate nature and extent of contamination.
- Laboratory analysis for physical and general geochemical characteristics of soil samples collected from monitoring well borings.

Soil borings were drilled at each of the monitoring wells installed as part of the groundwater characterization. Continuous soil sampling was conducted from the ground surface to the glaciolacustrine sediment surface at each location. Continuous samples were retrieved with the use of split-spoon sampling techniques. Soil samples were classified according to a modified Burmister soil classification system.

Soil borings advanced for shallow monitoring well installations were conducted with a standard hollow-stem auger drilling and continuous split-spoon sampling techniques. Soil borings advanced for intermediate and deep monitoring well installations were conducted with standard drive-and-wash and split-spoon sampling techniques. Soil borings advanced as part of the contaminant delineation borings were installed using Geoprobe® direct-push techniques. For monitoring wells, the procedures for drilling, sampling, and decontamination are included in *Technical Memorandum (TM) 1, Monitoring Well Installation and Development and Soil Sampling*. For soil borings, the procedures for drilling, sampling, and decontamination are included in*(TM) 5, Soil Boring Installation and Soil Sampling*

All spent decontamination fluids generated during drilling activities and purge water generated during monitoring well development activities for the investigation were placed in 55-gallon, closed-top drums supplied by Pratt & Whitney (P&W) for subsequent off-site disposal by P&W. The drums were labeled, the wells contributing to each was listed, and the information tracked to aid in waste characterization and disposal.

All soil cuttings generated during drilling activities were placed in 55-gallon, open-top drums supplied by P&W for subsequent off-site disposal by P&W. The drums were labeled, the wells contributing to each was listed, and the information tracked to aid in waste characterization and disposal.

Soil samples were screened in the field for total VOCs using a portable photoionization detector (PID) or a flame-ionization detector (FID). The results of the field screening provided initial information on subsurface VOC contamination. In addition, soil samples collected as part of the contaminant delineation investigation were analyzed at the LEA Analytical Laboratory for target VOCs using a portable gas chromatograph (GC). Screening results were used to help select soil samples for analyses at an off-site analytical laboratory. The screening analyses conducted at the LEA Analytical Laboratory are described in *TM 7 Loureiro Engineering Associates Analytical Laboratory.*

3.2.2 Groundwater Investigations

The purpose of the groundwater characterization portion of the environmental setting investigation was to define groundwater elevations and aquifer characteristics across the Site. The object was to characterize the hydrogeologic characteristics and groundwater flow regime across the Site in order to understand and evaluate potential contaminant fate and transport pathways and mechanisms.

This section describes the installation of new monitoring wells (including cluster wells that are screened in deeper portions of the unconsolidated aquifer), aquifer testing methodologies, and the collection of water-level measurements. Analysis of groundwater for water quality is described in Section 3.3.2.

3.2.2.1 Installation of New Monitoring Wells

This section describes the installation of new monitoring wells designed to provide the information for refining the conceptual model of site hydrogeology. These wells were installed within soil borings described in the previous section.

In general, these new wells were planned as shallow, water-table monitoring wells to monitor hydraulic head and water quality in the upper portion of the unconsolidated aquifer. Monitoring well locations were selected not only for the purposes of obtaining hydrogeologic data, but also for obtaining water-quality information relative to potential contaminant source areas.

Well depths for newly installed water-table wells were based on the depth to groundwater at the individual well locations. These wells were screened to a depth of approximately 5 to 7 feet below the top of the water table.

Well depths for any intermediate or deep wells were determined after the soil boring at each well cluster location was completed, at which time the depths to various subsurface horizons were known and identification of aquifer materials had been completed.

3.2.2.2 Well Locations

The installation of multiple-well clusters, and shallow wells has been conducted over a period of years in response to the needs of various environmental investigations. Table 3-1 summarizes the rationale for installation of groundwater monitoring wells at the Site. A total of 2 well cluster locations, 50 shallow well locations, and 16 piezometers have been installed in the Airport/Klondike Area, to address either hydrogeologic or water-quality data gaps.

3.2.2.3 Well Construction

The monitoring wells were constructed of 2-inch diameter, Schedule 40 polyvinyl chloride (PVC) flush-threaded screen and casing, except at specific wells (i.e., NA-MW-05 through NA-MW-07, NK-MW-18, and NK-MW-19) where 0.5-inch diameter, Schedule 40 PVC Geoprobe® Prepack screen and casing were installed with the Geoprobe®. Construction materials and procedures for the standard monitoring wells were in general accordance with the *RCRA Ground-Water Monitoring Technical Enforcement Guidance Document*, OSWER-9950.1 and the *Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells (EPA 600/4-89/034)* (U.S. EPA/NWWA, 1989).

Screen lengths for all of the shallow monitoring wells were no longer 10 feet. Screens for the shallow wells were positioned across the water table, as observed at the time of installation, with approximately 5 to 7 feet of screen placed below the water table. For the intermediate and deep wells, 5-foot screen lengths were used. The screened intervals for the intermediate and deep wells were determined based on observations made during soil sampling (i.e., visual indications, odor, or screening for volatile organics) and the intended vertical position within the aquifer.

A description of well construction and completion procedures used, including a schematic illustration of a typical monitoring well, is found in *TM 1, Monitoring Well Installation and Development and Soil Sampling*. Upon completion, the horizontal location and elevation of the new wells and existing wells, were surveyed.

In addition to the permanent groundwater monitoring wells installed throughout the Airport/Klondike Area, Geoprobe® screenpoint samples were collected from discrete locations. Geoprobe® Screen-Point samplers are temporarily emplaced sampling devices consisting of a stainless-steel well screen driven to the desired sampling depth and unsheathed. Groundwater samples are collected as if from monitoring wells, however, the sampling devices remain in the borehole only as long as necessary to collect the sample. The techniques used to collect screenpoint groundwater samples is detailed in TM 1. Screenpoint groundwater samples were used to supplement the groundwater quality data collected from the permanent monitoring well network and to direct the location of permanent monitoring wells.

3.2.2.4 Well Development

Completed monitoring wells were developed no sooner than 72 hours after well completion to allow grout materials time to set up. Development was performed to remove fine sediment from the well, the screen openings, and filter pack and to facilitate groundwater flow to the well. Development procedures included pumping and surging using a surge block and submersible or inertial pumping methods. Development of Geoprobe® Prepack monitoring wells was performed by pumping, since the small internal diameter of these wells does not allow effective surging.

Development continued until the turbidity of water produced from the well was below specified criteria and until pH, temperature, and conductivity had stabilized. Development methods and criteria are specified in *TM 1, Monitoring Well Installation and Development and Soil Sampling.*

Equipment used inside the well casing was dedicated or decontaminated prior to use. Development water was placed in 55-gallon, closed-top drums supplied by P&W for subsequent off-site disposal by P&W. The drums were labeled, the wells contributing to each was listed, and the information tracked to aid in waste characterization and disposal.

3.2.2.5 Water-Level Measurements

Groundwater elevations was measured in all newly installed wells and existing wells using an electronic water-level measurement device. Water levels were measured to the nearest 0.01 foot. Reference elevations for the monitoring wells were surveyed to the National Geodetic Vertical Datum (NGVD) of 1929. Procedures for collecting water-level measurements and surveying locations are detailed in *TM 2, Water-Level Measurements and Site Survey Data.*

Water-level measurements were collected on various occasions beginning in 1990, and continuing through 1998. Data from select measuring events were used to produce contour maps

of water-table elevations and to evaluate horizontal and vertical hydraulic gradients within the aquifer. These contour maps are presented in TM 2.

3.2.2.6 Hydraulic Conductivity Testing

During March 1990, *In situ* aquifer testing was performed at ten well locations in the Airport/Klondike Area, all of which produced usable data. All but one of the wells, SK-MW-08D, were screened across the water table. Monitoring well SK-MW-08D was screened in the glaciolacustrine sediments. Aquifer testing consisted of "slug/bail tests" to determine hydraulic conductivity of the aquifer materials. The slug tests were performed and analyzed in accordance with the Bouwer and Rice methodology.

Hydraulic conductivity values for the upper portion of the aquifer, as estimated from the test data, ranged from approximately 6.8 feet per day (0.002 centimeters per second) to 53.5 feet per day (0.019 centimeters per second). These data are consistent with published hydraulic conductivity values for similar geologic materials. However, the test data from SK-MW-01 indicated a hydraulic conductivity of approximately 0.46 feet per day (1.6×10^{-4} centimeters per second). This value is approximately two orders of magnitude below the typical hydraulic conductivity values for similar materials. There is no apparent cause for this discrepancy.

Hydraulic conductivity values for the glaciolacustrine sediments, as estimated from the test data, was approximately 0.0065 feet per day (2.3×10^{-6} centimeters per second). This value is consistent with published hydraulic conductivity values for similar geologic materials.

3.2.3 Surface Water / Groundwater Interaction

Surface water/groundwater interactions in the Airport/Klondike Area were estimated by measuring the difference in water levels between the upper aquifer and the surface water body. Three surface water piezometers, SK-PZ-01 through SK-PZ-03, have been installed in Pewterpot Brook in the South Klondike Area. These piezometers begin in the area just west of the Virgin Product Storage Area and continue south to approximately the southeast corner of the airport. These three piezometers allow simultaneous measurement of the stage of Pewterpot Brook and the water table elevation at the same location, and therefore, an estimation of the surface water/groundwater interaction in that area.

Two surface water piezometers, NK-PZ-01 and NK-PZ-02, have been installed in unnamed tributary to Pewterpot Brook in the North Klondike Area. These piezometers are located in the portion of the surface water immediately west of the X-430 Area. These two piezometers allow simultaneous measurement of the stage of the unnamed tributary and the water table elevation at

the same location, and therefore, an estimation of the surface water/groundwater interaction in that area.

In the South Klondike Area, measurements of the stage of the brook and water-table elevation have been made during the water level gauging events of 1997. These data have been used to calculate the apparent direction of groundwater flow between the brook and the upper aquifer. These data are presented in *TM 2 Water-Level Measurements and Site-Survey Data.*

During both the June 1997 and November 1997 events, the water-level measurements indicate that Pewterpot Brook is a gaining stream in the reach between SK-PZ-01, west of the Virgin Product Storage Area, southward to SK-PZ-02. That is, the elevation of the water table is higher than the stage of the stream and groundwater would tend to flow from the aquifer into the stream. During the June 1997 event, the data collected from piezometer SK-PZ-03 indicated that the stream was a losing stream in that portion of the stream, but was a gaining stream during the November 1997 gauging event.

Where is this?

3.2.4 Surface Water and Sediment Investigations

Surface water and sediment samples have been collected from selected locations throughout the Site to evaluate the potential impacts of site activities on those media. A total of thirty-five surface water and sediment sampling locations have been established in the Airport/Klondike Area: two in the North Airport Area, six in the North Klondike Area, ten in the South Airport Area, and seventeen in the South Klondike Area. These surface water/sediment locations have been situated in Willow Brook, Pewterpot Brook, and the various unnamed tributaries to these streams. The locations of these sampling points has been chosen to provide relatively complete coverage of the surface water bodies on the Site. These surface water/sediment sampling locations have been surveyed to provide a horizontal location data.

In some cases, the surface water/sediment sampling locations are simple staff gauges, from which surface water elevation data can be determined. In other cases the surface water/sediment sampling locations are stream piezometers from which both surface water and groundwater elevation data can be determined.

Sediment sampling during the most recent investigation activities was conducted in general accordance with the LEA SOP *Standard Operating Procedure for Sediment Sampling in Shallow Rivers and Ponds.* Sediment samples were collected at the same spatial locations as surface water samples. Sediment samples were collected using pre-cleaned, stainless steel hand trowels or scoops, or hand augers. After collection, the sampling device was brought to the surface and

the sediment was transferred to pre-labeled laboratory-supplied sampling containers using stainless-steel spatulas.

Surface water samples were collected by first identifying the appropriate sampling location. The sampling location was approached from a downstream direction, disturbing the bottom sediments as little as possible, and the depth to the surface water surface from the surveyed reference point was gauged. Sample containers were filled directly from the stream flow by immersion of the pre-labeled laboratory-supplied sample containers into the stream waters. Sample information, including date and time, location, sample number, depth to the surface water, and pertinent observations were recorded on the appropriate field forms.

After collection, all samples were placed into iced coolers for transportation to the analytical laboratory under chain-of-custody control.

Specific data and a more detailed discussion of the sample collection techniques employed in collecting surface water and sediment samples is presented in TM 6 *Surface Water and Sediment Sampling*.

3.3 Contaminant Delineation Investigation

The primary objectives of the contaminant delineation investigation were to define the nature and extent of contamination in potentially affected media across the site. The approach consisted of two principal phases:

- Identification and nature of contamination
- Delineation of the extent of contamination, as appropriate.

This section is organized by the different media that potentially have been affected by releases of hazardous material at the facility. Soil is discussed first, followed by groundwater. Detailed discussions of the field methodologies employed in these investigations, standard operating procedures for the field activities, and descriptions of the results of the contaminant delineation investigation are included in the appropriate TMs and USTMs presented in this report.

3.3.1 Soils Contaminant Delineation Investigations

This section describes the scope of sampling activities that were conducted to define the nature and extent of soils contamination in the unsaturated zone across the site. Any contamination detected could indicate potential source areas for future migration to groundwater and/or surface water. The data collected through this investigation was also used in developing the site-wide

conceptual hydrogeologic model. The nature and extent of contamination present in the saturated zone is addressed in Section 3.3.2.

The approach to the delineation of contamination varied across the Site depending on the probability of contamination, relative impact of potential contamination, types of contaminants, and the physical mechanisms of contamination. The soil sampling approach varied in terms of the number and spatial distribution of samples and the types of analyses performed. A detailed discussion of the sampling approach at each potential contaminant source area is presented in the TMs and Unit-Specific Technical Memoranda (USTMs) provided in this report.

The general approach to the delineation of contamination in unsaturated zone soils was as follows. The nature of contamination at individual areas or environmental units was assessed through initial sampling. If results indicated that contaminants were present, an evaluation of the need for additional sampling was made. When appropriate, the extent of contamination was assessed through a supplemental boring and soil sampling program. The supplemental sampling program assessed the horizontal and vertical distribution of contaminants and provided information to evaluate potential remedial measures as necessary.

The nature of contaminants in each area was characterized by analyzing soil samples for those constituents that have the potential to be present in the subsurface due to historical activities in that particular area. The results of the analyses performed during the initial round of sampling were used to select indicator parameters for any sampling to determine the extent of contamination that was or would have been undertaken. Typically, an analytical method was eliminated if data indicated that a constituent had not been detected or was significantly below reference levels. The initial analytical results for constituents such as metals and SVOCs from a specific environmental unit was typically deemed to be sufficient to adequately characterize the nature and extent of those constituents in that unit.

Screening of soil samples using a portable gas chromatograph (GC) was conducted for target VOCs at those locations where VOCs were potential contaminants. Screening results were used to aid in the selection of soil samples that were to be submitted for more comprehensive analysis at an offsite laboratory. Screening level analytical data were collected for soil samples collected from most of the environmental units at the Site.

The initial sampling program at a given environmental unit was designed to characterize the nature of contaminants present in soils at each location. This characterization consisted of sampling soils within each area and analyzing the samples for the constituents noted in the USTMs presented in this report. A list of all potential constituents for which analysis might be

performed was presented in the Voluntary Corrective Action Program Work Plan, along with the analytical methods and practical quantitation limits for the individual constituents.

After the initial round of sampling and analysis was performed in a given area, one of two subsequent steps, was generally taken.

- If it was not clearly evident that additional investigation was necessary to characterize the nature and extent of contamination at that unit, no further investigation was undertaken at that time.

- If the presence of contamination was confirmed above reference levels and/or additional information was clearly required in order to adequately characterize the extent of the release, to determine whether further action was warranted, and/or to evaluate appropriate subsequent actions to address the release, supplemental sampling was conducted in the area.

Any supplemental sampling deemed necessary was designed to assess the vertical distribution and the horizontal extent of contaminants in the unsaturated zone to evaluate potential remedial measures. For organic compounds, the list of indicator parameters included the class of organic compounds detected during the initial sampling. For example, if PCE was detected, then other chlorinated VOCs, such as degradation products, were included in the list of indicator parameters. For selected areas, analysis of Synthetic Precipitation Leaching Procedure (SPLP) extract for metals was conducted on selected samples for evaluating the leachability of those inorganic constituents. If the concentrations of inorganics was representative of background concentrations and did not indicate a release, SPLP analyses were not conducted.

3.3.2 Groundwater Contaminant Delineation Investigations

This section describes the scope of sampling activities that were conducted to define the nature and extent of groundwater contamination in the saturated zone across the Site. Any contamination detected in groundwater could indicate potential source areas for future migration to surface water and/or to volatilize to the air. The data collected through this investigation was also used in developing the site-wide conceptual hydrogeologic model.

The approach to the delineation of groundwater contamination varied across the Site depending on the probability of contamination, relative impact of potential contamination, types of contaminants, and the physical mechanisms of contamination. The groundwater sampling approach varied in terms of the number and spatial distribution of samples and the types of

analyses performed. A detailed discussion of the sampling approach at each potential contaminant source area is presented in the TMs and USTMs provided in this report.

The nature of contamination at individual areas or environmental units was assessed through initial soil sampling, and, where available, from groundwater quality data. If results indicated that contaminants were present, an evaluation of the need for additional sampling was made. When appropriate, the extent of contamination was assessed through a supplemental groundwater sampling program. The supplemental sampling program assessed the horizontal and vertical distribution of contaminants and provided information to evaluate potential remedial measures.

The nature of contaminants in each area was characterized by first analyzing soil samples for those constituents that had the potential to be present in the subsurface due to current or historical activities in that particular area and by reviewing any available groundwater quality data. The results of the analyses performed during the initial round of sampling were used to select indicator parameters for any sampling to determine the extent of contamination that was or would have been undertaken. An analytical method was eliminated if data indicated that a constituent had not been detected or was significantly below reference levels.

The initial sampling program at a given environmental unit was designed to characterize the nature of contaminants present in the groundwater at each location. This characterization consisted of sampling the groundwater at each area and analyzing those samples for the constituents noted in the USTMs presented in this report. A list of all potential constituents for which analysis might be performed was presented in the Voluntary Corrective Action Program Work Plan, along with the analytical methods and practical quantitation limits for the individual constituents.

After the initial round of sampling and analysis was performed in a given area, one of two subsequent steps, was generally taken.

- If it was not clearly evident that additional investigation was necessary to characterize the nature and extent of contamination in the groundwater at that unit, no further investigation was undertaken at that time.

- If the presence of contamination was confirmed above reference levels and/or additional information was clearly required in order to adequately characterize the extent of the impacts to groundwater, to determine whether further action was warranted, and/or to evaluate appropriate subsequent actions to address the contamination, supplemental groundwater sampling was conducted in the area.

Any supplemental sampling deemed necessary was designed to assess the horizontal and vertical extent of contaminants in the groundwater and the likely source of those contaminants to evaluate potential remedial measures. For organic compounds, the list of indicator parameters included the class of organic compounds detected during the initial sampling. For example, if PCE was detected, then other chlorinated VOCs, such as degradation products, were included in the list of indicator parameters.

TABLES

Table 3-1 Monitoring Well Locations and Rationale Airport/Klondike Area, Pratt & Whitney, East Hartford, Connecticut	
Monitoring Well ID	**Rationale/General Location**
NA-MW-01	Areal coverage - North Airport
NA-MW-02	Areal coverage - North Airport
NA-MW-03	Areal coverage - North Airport
NA-MW-04	Areal coverage - North Airport
NA-MW-05	Former Pickle Company
NA-MW-06	Former Pickle Company
NA-MW-07	Former Pickle Company
NA-PZ-01	Water levels - North Airport
NA-PZ-02	Water levels - North Airport
NA-PZ-03	Water levels - North Airport
NA-PZ-04	Water levels - North Airport
NA-PZ-05	Water levels - North Airport
NA-PZ-06	Water levels - North Airport
NA-PZ-07	Water levels - North Airport
NA-PZ-08	Water levels - North Airport
NA-PZ-09	Water levels - North Airport
NA-PZ-10	Water levels - North Airport
NA-PZ-11	Water levels - North Airport
NA-PZ-12	Water levels - North Airport
NK-MW-01	Northeastern property corner
NK-MW-02	Suntan Area
NK-MW-03	Suntan Area
NK-MW-04	Suntan Area
NK-MW-05	Suntan Area
NK-MW-06	Soil storage area
NK-MW-07	Former tank farm
NK-MW-08	Former PCB Storage Building
NK-MW-09	Former PCB Storage Building
NK-MW-10	Former PCB Storage Building
NK-MW-11	Former PCB Storage Building
NK-MW-12	South of Suntan Area Access Road
NK-MW-13	X-314 Test Stand
NK-MW-14S	X-410 and X-412 Test Stands
NK-MW-15S	Western North Klondike areal coverage
NK-MW-16	X-430 through X-436 Test Stands Steel Tank Area
NK-MW-17	North Klondike Soil Piles
NK-MW-18	X-430 Test Stand
NK-MW-19	X-401 Test Stand

Table 3-1 Monitoring Well Locations and Rationale Airport/Klondike Area, Pratt & Whitney, East Hartford, Connecticut	
Monitoring Well ID	**Rationale/General Location**
NK-PZ-01	Water levels - North Klondike
NK-PZ-02	Water levels - North Klondike
SA-MW-01	Fire Training Area
SA-MW-02I	Contractor Storage Area
SA-MW-03	Fire Training Area
SA-MW-04	Contractor Storage Area & Former Soil Stockpile
SA-MW-05I	Monitor base of aquifer at SA-WM-05S
SA-MW-05S	Contractor Storage Area
SA-PZ-01	Water levels - South Airport
SA-PZ-02	Water levels - South Airport
SK-MW-01	South Klondike Graoundwater Quality
SK-MW-02	South Klondike Graoundwater Quality
SK-MW-03	South Klondike Graoundwater Quality
SK-MW-04	South Klondike Graoundwater Quality
SK-MW-05	Virgin Product Storage Area
SK-MW-06	Fire Training Area
SK-MW-07	Chemical Storage Building in Linde Area
SK-MW-08D	Base of aquifer at SK-MW-08S
SK-MW-08S	North-South Airport Area
SK-MW-09	Stratigraphy - Eastern property corner
SK-MW-10	Stratigraphy - Eastern property corner
SK-MW-11	Quonset Hut
SK-MW-12	Fire Training Area
SK-MW-13	Southeast property corner
SK-MW-14I	Storage Yard 3
SK-MW-15I	Former drum storage area south of Cryogenics Builidng
SK-MW-16	Fire Training Area and Tie-Down Area
SK-MW-19	Virgin Product Storage Area
SK-MW-20	Virgin Product Storage Area
SK-MW-21	Virgin Product Storage Area
SK-MW-22	Virgin Product Storage Area
SK-MW-23	Virgin Product Storage Area
SK-MW-24	Virgin Product Storage Area

DRAFT

TECHNICAL MEMORANDUM 8
GEOPHYSICAL SURVEYING

SUMMARY
SITE INVESTIGATION AND REMEDIATION REPORT
AIRPORT/KLONDIKE AREA
AT
PRATT & WHITNEY
EAST HARTFORD, CONNECTICUT
EPA ID No. CTD990672081

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DRAWINGS

Acronyms

DC	Direct Current
DEP	State of Connecticut Department of Environmental Protection
DPH	State of Connecticut Department of Public Health
EM	Electromagnetic Terrain Conductivity
F&O	Fuss & O'Neill, Inc.
GPR	Ground Penetrating Radar
H&A	Haley & Aldrich, Inc.
LEA	Loureiro Engineering Associates, Inc.
M&E	Metcalf & Eddy, Inc.
MHz	Megahertz
MSL	Mean Sea Level
P&W	Pratt & Whitney
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control
SOP	Standard Operating Procedure
TM	Technical Memoranda
VPSA	Virgin Product Storage Area

1. INTRODUCTION

1.1 Purpose and Objective

This Technical Memorandum (TM) presents the methodology and results of the geophysical surveying conducted in the Airport/Klondike Area (Site) of the Pratt & Whitney (P&W) facility located at 400 Main Street (Main Street facility) in the Town of East Hartford, Connecticut. Geophysical surveying using various techniques was conducted to:

- define the upper surface of the glaciolacustrine sediments in the South Klondike Area;
- to locate and determine the boundaries of former septic systems associated with the former Army barracks and training area located in the North Airport Area;
- to locate and determine the boundaries of former septic systems associated with former test stands in the Klondike Area;
- to determine the existence of the magnetic anomalies in the Airport/Klondike Area; and,
- to determine the depth to bedrock in the Airport Area.

1.2 Background

The Airport/Klondike Area is located on the eastern portion of the P&W Main Street facility on the east side of the main plant, north of Brewer Street and south of Silver Lane. The Airport/Klondike Area consists of four study areas that include the North and South Airport Areas and the North and South Klondike Areas. Previous investigations at the Site performed from 1990 through 1993 resulted in the installation and sampling of soil borings, groundwater monitoring wells and temporary wellpoints, surface water and sediment throughout the Airport/Klondike Area. Additional investigations have been conducted to define geologic conditions and anthropogenic structures at the Site which could impact contaminant transport and assist in conducting investigation activities.

1.3 Scope

This TM covers the techniques and methodologies of the geophysical surveying conducted in the Airport/Klondike Area. The methods and techniques discussed are those used by geophysical contractors and consultants during the period from approximately 1990 through 1996.

~ 37 GPR lines ?

Anomalies discussed in 4 STMs

1.4 General Geologic and Hydrogeologic Conditions

The geologic and hydrogeologic characteristics of the Site are discussed in detail in the main body of this report. In general, the surficial materials, in which the majority of the monitoring wells are screened, consist of medium to fine grained sands with trace levels of fine gravels and coarse sands. These sediments are generally post-glacial, fluvial deposits associated with the Connecticut River, although in many places the upper portion of these sediments has been anthropogenically disturbed during on-site construction activities. Beneath the fluvial sediments are glaciolacustrine sediments, primarily laminated silts and clays, associated with glacial Lake Hitchcock. The basal sediment layer over most of the area is glacial till and stratified drift. Bedrock in the general East Hartford area consists of Triassic Age, interbedded arkoses and basalts. Bedrock in the area has a general slight dip eastward cut by widespread steep faults.

The regional drainage basin is the Upper Connecticut River Basin. Regional flow in the unconsolidated materials of this part of the basin is to the west, towards the Connecticut River. Local groundwater flow is also controlled to some extent by local drainage sub-basins and topography. The upper portion of the unconsolidated sediments serves as the primary aquifer in the area. Groundwater flow in the bedrock is primarily within fractures and fault planes, and to a lesser extent within the rock matrix. The local bedrock aquifer would be an adequate as a residential water supply source, but groundwater yields are typically too low to be of commercial or industrial use.

1.5 Geophysical Surveying Techniques

Various geophysical surveying techniques have been applied at the Site to provide different information regarding the nature of the surficial materials at the Site. These methods include seismic refraction surveying, electromagnetic surveying, ground penetrating radar surveying, and magnetometry.

Seismic refraction surveying consists of measuring the time it takes sound waves to travel through materials and relating that time to the nature of the materials. Seismic refraction surveying uses a system of vibration-sensitive receivers to detect and record sonic energy refracted from subsurface horizons. Seismic refraction surveying has been used in the Airport Area to define the depth to bedrock and the general nature of the unconsolidated materials.

Electromagnetic surveying consists of measuring the response of the geologic materials to induced electromagnetic fields. Electromagnetic surveying uses a coupled transmitter and receiver to induce and measure electromagnetic eddy currents in buried conductive objects.

Electromagnetic surveying has typically been used to locate areas where buried metallic objects may be located.

Ground penetrating radar (GPR) surveying consists of recording and converting radar signals reflected from subsurface materials. The GPR system transmits and receives pulsed electromagnetic energy and converts the received signals into indications of the change of the dielectric constants between subsurface materials or buried objects. GPR surveying has typically been used to located buried objects, such as pipes or tanks, that have significantly different dielectric properties from the surrounding soil.

Magnetometry is the measurement of variations in the normal magnetic field caused by the presence of buried magnetically susceptible objects. The magnetometry system consists of a magnetic field detector mounted on a staff to provide a constant height above the ground surface and connected to a recording device. Magnetometry is typically used to locate buried metallic objects.

2. METHODOLOGY

This section presents the general procedures and methodologies used to conduct and analyze the data from the various geophysical surveying techniques used in the Airport/Klondike Area. These methods were used by LEA, and also by previous consultants and contractors who performed geophysical surveying at the Site.

2.1 Seismic Refraction Surveying

Seismic refraction surveying was conducted on December 6 through 8, 1989, in the Airport Area by Weston Geophysical, Corp., as subcontractors to Westinghouse Environmental and Geotechnical Services, Inc.

Seismic refraction surveying consists of measuring the time-of-travel associated with compressional, or "P," seismic waves. The time-of-travel of the seismic waves can be related to the nature, composition, degree of induration, and degree of saturation of the material the waves are traveling through.

The seismic waves are generated by a "shot," or high-velocity acoustic wave generation event, at the "shot point," or the location of the shot. The shot can be generated by various sources such as air guns, hand-held drop weights, or small explosive charges. The waves are detected by vibration sensitive devices known as geophones. Geophones convert the seismic vibrations, or waves, into electrical signals and transmit those signals to a recording device through dedicated cables.

Interpretations of the geology are made from the analysis of the travel time curves which show the time required for each compressional seismic wave to travel from the shot point to the geophones. In general, velocity ranges of approximately 500 to 6,000 feet per second are indicative of unconsolidated sandy or gravelly materials. The lower velocity range is indicative of unsaturated materials with the seismic velocity range increasing with increasing saturation and density. Seismic velocity ranges of approximately 500 to 8,000 feet per second are indicative of clay units. Seismic velocity ranges of approximately 5,000 to 16,500 feet per second are indicative of consolidated rocks such as sandstone. Bedrock can have seismic velocities which span the entire range from that of unconsolidated sediments upwards, depending upon the type of bedrock and the degree of weathering and/or fracturing.

2.2 Electromagnetic Terrain Conductivity Surveying

Electromagnetic terrain conductivity (EM) surveying was performed on December 4 through 7, 1989, in the Airport/Klondike Area by Westinghouse.

EM uses a transmitter, or coil, to generate a magnetic field. The magnetic field induces eddy currents within the earth. The eddy currents produce secondary electromagnetic fields which are measured by a receiver coil. The strength of the secondary electromagnetic fields is related to the conductivity of the subsurface materials. The measured conductivity is the weighted cumulative sum of the conductivities from the surface to the effective depth of the instrument. The effective depth of the instrument is a function of the separation of the transmitting and receiving coils.

EM is useful for mapping of shallow conductive bodies, including conductive contaminant plumes, for the detection of buried bulk wastes, and for the detection of buried metal containers, including steel tanks and drums. However, EM is susceptible to interference from powerlines and surficial metals, and lacks vertical resolution compared to direct current (DC) electrical resistivity methods.

2.3 Ground Penetrating Radar Surveying

Ground penetrating radar surveying (GPR) was used on May 24 through 26, 1993 in the South Klondike Area by Fuss & O'Neill, Inc. (F&O), and on August 6, 1996 in the former Army Barracks Area, on August 12, 1996 in the X-312/X-314 Test Stand Area, on September 6, 1996 in the former Explosives Storage Area and Linde Gas/Chemical Storage Building Area, and on October 15, 1996 in the former Silver Lane Pickle Company Area by Kick Geoexploration.

GPR is a geophysical technique based on the transmission and reflection of short, rapid bursts of high frequency radio waves. In practice, a GPR system consists of an integral transmitter and receiver which are dragged on the ground surface along a transect. The transmitting antenna emits electromagnetic radiation at a frequency between 80 Megahertz (MHz) and 1,000 MHz, depending on the receiving antenna. The receiver records the reflected GPR signal strength. These data can later be transferred to plotting devices for graphic output.

In the subsurface, a portion of the electromagnetic energy is reflected back toward the transmitter when an interface between two materials with differing electrical properties is intercepted. The effectiveness of a buried object as a reflector is a function of the contrast between the electrical properties of the buried object and the sediments. The effectiveness of GPR to identify buried objects is also dependent on the electrical properties of the sediments. In general, conductive

media such as silt and clay are effective GPR reflectors and thus limit the effective depth of the GPR signal. Less conductive sediments, such as sand and gravel, are less effective GPR reflectors and the effective depth of GPR signal penetration is much greater.

Interpretation of GPR is typically performed by visual inspection of the form and distribution of the reflected GPR signals. These data are translated into estimates of locations and interpretations of buried objects along the line of the GPR transect. When GPR is used to establish the geometry of the upper surface of a reflecting horizon, a combination of GPR and ground truthing is used to establish points on the reflecting horizon from which interpolations can be based. Ground truthing is the use of established depths, typically derived from borehole data, in conjunction with the GPR results.

2.4 Magnetometry

Magnetometer surveys were performed by Kick Geoexploration on September 6, 1996, in the former Linde Gas/Chemical Storage Building Area, and the Tie-Down Area, and on October 15, 1996 in the former Silver Lane Pickle Company area.

Magnetometry surveying uses a sensitive magnetometer to measure and record anomalies and variations in the prevailing terrestrial magnetic field. The surveying technique uses a detector attached to a staff so that the detector is maintained a constant distance above the earth during the surveying. The detector is attached to a recording device.

In practice, a local base station is chosen where there is minimal variation in the magnetic field intensity, and all measurements are reported relative to the magnetic intensity detected at the base station. During the surveying, magnetic measurements are made and recorded at locations along a predefined grid. These magnetic intensities are then plotted and analyzed to determine the presence of anomalies that may represent buried metallic objects.

2.5 Quality Assurance/Quality Control Procedures

Quality assurance/quality control (QA/QC) procedures used in performing the geophysical surveying varied depending upon the specific geophysical procedure used. For EM, the typical procedure was to perform functional tests of the instrumentation at the beginning of each work day, including checking the batteries, instrumental zero setting, instrumental sensitivity, compensation, and phase controls. In addition, background conductivity measurements were made at the beginning of each day in an area of the North Klondike identified as undisturbed.

The QA/QC procedures for GPR, magnetometry, and seismic refraction activities is limited to maintaining instrument calibration and performing proper instrument maintenance.

2.6 Decontamination of Materials and Equipment

Because geophysical surveying are not intrusive techniques, there is no need for decontamination between different transects or between different methods.

2.7 Waste Management

No wastes were generated by the geophysical surveying techniques employed at the Site.

2.8 Health and Safety

LEA field personnel conducted field activities in accordance with the LEA Site Health and Safety Plan that was prepared for all of the investigation activities included on the Site. In general, geophysical surveying was conducted in modified Level D personal protective equipment (PPE) consisting of safety glasses and surgical or nitrile gloves, and steel-toed shoes. Geophysical surveyors employed as subcontractors operated in accordance with their specific health and safety plans.

3. RESULTS

3.1 Seismic Refraction Survey

A total of 7,190 foot seismic refraction line was profiled along the eastern edge of the airport runway on December 6 through 8, 1989. The location of the seismic profile is shown on Drawing TM8-1. Based on overlapping geophone spreads, data sets from multiple seismic profiles were analyzed and correlated. An analysis of the seismic refraction data, based on seismic velocity only, was performed to characterize the thickness of the unconsolidated materials. Topographic elevation data from survey data and airport drainage plans was used to provide surface elevation data along the seismic line (Weston Geophysical Corp., 1990).

The seismic velocity data was separated into three groups, based on the relative degree of induration, the degree of saturation, and the composition of the materials present. The relatively loose, unconsolidated, unsaturated surficial materials had seismic velocities of 1,200 to 1,600 feet per second. Seismic velocities in this range are consistent with a variety of unsaturated sediments. These unsaturated materials, interpreted to be stream terrace deposits, were between 10 to 4 feet thick: thickest in the southwestern portion of the runway, where the water table is deepest, and gradually thinning toward the northeast.

Beneath the unsaturated materials was a layer characterized by intermediate seismic velocities of 4,850 to 4,900 feet per second. Seismic velocities in this range would be characteristic of saturated or clay-rich materials. This zone was interpreted to be saturated stream terrace deposits and glaciolacustrine sediments. These materials were interpreted as continuing to bedrock.

Beneath the zone of intermediate seismic velocities was a zone with seismic velocities approximately between 12,500 to 13,200 feet per second. This zone was interpreted to be bedrock. Seismic velocities in this range are consistent with those for sound sandstone or shale. These materials were not found to be of a defined thickness, that is, there was no additional underlying rock layer noted within the depth range of the seismic energy wave.

The bedrock surface, as interpreted from the seismic refraction profile, is approximately 277 feet deep in the southwest end area of the runway. The bedrock surface rises to a depth of approximately 135 feet within the first 3,000 feet from the southwest end area of the runway. Over the course of the next 4,190 feet of the seismic profile, the bedrock surface rises to a depth of 81 feet below the ground surface. The bedrock surface interpreted from these data is consistent with bedrock elevation data interpolated from test boring and production well logs for the East Hartford area.

There was no indication of a weathered or highly fractured zone in the upper portion of the bedrock. In addition, because of the range of seismic velocities observed, it was not possible to determine whether a zone of glacial till or stratified drift was present beneath the glaciolacustrine sediments.

3.2 Electromagnetic Terrain Conductivity Survey

EM surveys were conducted along eleven transects in the Airport/Klondike Area on December 4 through 7, 1989. During the survey, terrain conductivity measurements were recorded every 100 feet along the established survey lines. Also, measurements were continuously monitored so that conductivity anomalies could be identified. The location of the terrain conductivity surveys is shown on Drawing TM8-2.

The first terrain conductivity survey was conducted along the airport runway, along the same transect used for the seismic refraction survey. During the survey, a number of anomalies were recorded. With the exception of three, all of these anomalies were associated with subsurface conduits having surface expressions or being otherwise traceable. The three remaining anomalies were thought to be due to conduits, possibly drain pipes, which lacked surface expressions or could not otherwise be traced.

Two terrain conductivity survey lines were conducted in the North Klondike fill piles. Three conductivity anomalies were recorded from known sources, including two buried conduits and surficial steel drums. An additional oval-shaped anomaly, approximately 11 by 25 feet, was also noted to the west of the profile lines.

Two terrain conductivity surveys were performed in Fire Training Area "B" at the southern end of the airport. Several anomalies were reported from this area. One was reported to have been caused by a portion of steel drum partially buried in the soil. Three additional anomalies were reported to probably have been caused by a "tar-like substance" located on the surface.

One terrain conductivity survey was conducted west of the Virgin Product Storage Area (VPSA). Two anomalies were reported from this area. One anomaly was reported from west of Storage Area 2. The other was reported from near the southern end of the profile line, across from the McIlvane Property. No visible cause for these anomalies was reported.

Two terrain conductivity surveys were conducted near the northwest corner of the Klondike Area. The conductivity anomalies detected in this area were reported to probably have been caused by the pavement in the area, or a sewer line which crosses the area.

Two terrain conductivity surveys were performed in the Contractor Storage Area. South of Contractors Road, the terrain conductivity values were typical of background. North of Contractors Road, the conductivity values were considerably higher. These elevated measurements were considered possibly to have been caused by the presence of road salt from snow removal activities. The presence of salt could increase the conductivity of the soil moisture in this area.

One terrain conductivity survey was performed in the vicinity of the former Maintenance Building in the X-401 Area of the North Klondike Area. One anomaly, probably due to the building's septic system, was reported from this area.

In addition to the terrain conductivity profile lines, random surveys of various areas were conducted in the Klondike Area. An isolated conductivity anomaly was reported from east of the former X-412 Test Stand area. No possible cause of this anomaly was reported. Other scattered conductivity anomalies detected in the Klondike Area appear to have been associated with various underground piping or crushed steel drums, metals pans and other metal items associated with the fire training exercises conducted in Fire Training Area A.

3.3 Ground Penetrating Radar Survey

3.3.1 South Klondike Area

A GPR survey was conducted in the South Klondike Area on May 24 through 26, 1993, to determine the geometry of the upper surface of the glaciolacustrine sediments, typically referred to as clay, in the area and to provide information regarding the presence of septic systems in the area of the Cryogenics Building. A total of nineteen transects were performed with survey stations established every twenty-five feet for horizontal and vertical control.

Based on a combination of ground truthing and the GPR results, the elevation of the upper surface of the glaciolacustrine sediments was established southward from the Cryogenics Building to the southern end of the Virgin Products Storage Area (VPSA). Based upon the interpreted GPR signal transmission times, the depth to the clay surface ranges from approximately 10 to 18 feet below grade. As illustrated on Drawing TM8-3, the general surface of the clay ranges from an elevation of approximately 35 feet above mean sea level (MSL) in the area of the Cryogenics Building, to approximately 28 feet MSL at the southern end of the VPSA. The clay surface generally slopes from east to west-southwest, with slight surface undulations in the area of monitoring well SK-MW-14I.

Based on the GPR profiles, septic systems were located near the Cryogenic Building in the South Klondike Area. The locations of these septic systems are shown on Drawing TM8-3.

3.3.2 Former Army Barracks Septic Systems

A total of sixteen GPR transects were performed in the North Airport Area on August 6, 1996, to determine the presence and location of septic systems associated with the former Army Barracks. The location of the GPR transects is illustrated on Drawing TM8-4. In general, the location of the former septic system tanks and associated piping were located based on the interpretation of the GPR signals. In addition, "cell" structures, apparently related to the former septic systems were also located. Based upon an interpretation of the GPR signals, these cell structures appear to be composed of columns of undisturbed native materials separated by areas of homogenous fill material.

Possible former septic system tanks associated with the former 150-man and 100-man latrines, former supply and administration building, and former operations building, were located. Cell structures associated with the former septic systems of the 100-man and 150-man latrines, former supply and administration building, and the former leach fields associated with the 100-man and 160-man latrines were located. Various potential pipes were located throughout the area surveyed.

3.3.3 Tie-Down Area

A GPR survey was conducted in the Tie-Down Area in conjunction with a magnetometry survey. A variety of targets, described as " a scattering of miscellaneous objects, some similar to pipes" were interpreted from the GPR survey results. At the location of the magnetic anomaly, discussed below, a "tank-like form" was interpreted, but the structure was reported to have a 4-tiered structure with radar reflectors at depths of approximately 5.5, 7.5, 9.5, and 11.5 feet below grade. The long axis of the reflecting structure was reported to be oriented east-west.

3.3.4 Silver Lane Pickle Company

A total of three individual GRP surveys were conducted in the former Silver Lane pickle Company area. All of the surveys were performed to determine the presence of buried tanks in the area. At the southwestern corner of the area a prominent cylindrical object at a depth of 4 to 5 feet was detected and interpreted to be a large pipe. In the remaining two areas various objects were detected, but not reflections characteristic of a buried tank were interpreted from the results.

The results of magnetic surveying conducted in this area, discussed below, were generally consistent with these interpretations. However, the magnetic survey indicated the possible

presence of buried tank in the northeastern corner of the area. There was no indication of a buried tank in the GPR survey results.

3.3.5 X-312/X-314 Test Stand Area

Approximately 900 lineal feet of GPR survey were conducted in the X-312/X-214 Test Stand Area. GPR signal penetration was reported at a few feet in the western portion of the transect to approximately 8 to 9 feet in the eastern portion. The difference in penetration was interpreted to be due to the presence of buried concrete rubble. A variety of buried radar reflectors were reported. These were interpreted to be due to possible large pipes or other buried debris. No reflections characteristic of buried tanks were noted.

3.3.6 Former Explosives Storage Area

A GPR survey consisting of approximately 300 lineal feet of transect was conducted in the former Explosives Storage Area. GPR signal penetration was reported to be approximately 13 feet. No GPR reflectors interpreted as consistent with buried tanks or pipes.

3.3.7 Linde Gas/Chemical Storage Building

A GPR survey consisting of a total of 300 lineal feet of transect was conducted in the Linde Gas/Chemical Storage Building Area on September 6, 1996. GPR signal penetration was reported to be approximately 9 feet. The results of the GPR survey were not reported except for the area surrounding the magnetic anomaly. No recognizable structures were interpreted from the GPR results in the area of the magnetic anomaly.

3.4 Magnetometry Survey

3.4.1 Tie-Down Area

A total of 72 grid node locations on approximately 10 foot intervals were surveyed. The data indicated the presence of various magnetic anomalies consistent with the presence of scattered buried metallic objects and steel-bearing rubble. One magnetic anomaly was interpreted to be consistent with that caused by presence of a buried tank. A GPR survey in the Tie-Down Area indicated the presence of a buried tank-like structure. The reported tank-like structure, as discussed in Section 3.3.3 above, displayed a 4-tiered structure with GRP reflectors at depths of 5.5, 7.5, 9.5, and 11.5 feet below grade, oriented east-west. No final interpretation of the structure was reported.

3.4.2 X-312/X-314 Test Stand Area

A total of 30 magnetic readings on an approximate 10-foot spacing were recorded from the X-312/X-314 Test Stand Area. The results were interpreted to indicate the presence of a "scattering of steel objects at the surface and buried." The report indicated that steel-bearing building rubble was visible on the ground surface in this area. There were no magnetic anomalies consistent with the presence of a buried tank noted in this area.

3.4.3 Silver Lane Pickle Company

The three area previously discussed under GPR survey results were also surveyed magnetically. The magnetic surveying results indicated a magnetic anomaly in the area of the southwestern corner of the area, consistent with a large pipe at a depth of 4 to 5 feet, and the possible presence of a buried tank in the northeastern corner of the area. GPR survey data did not indicate the presence of a buried tank, however.

An additional magnetic survey was conducted along the soil piles located in this area. No significant magnetic anomalies were noted during this survey.

3.4.4 Linde Gas/Chemical Storage Building

A total of 108 magnetic readings on an approximate 10-foot spacing were recorded from the Linde Gas/Chemical Storage Building area. The majority of the results were interpreted to indicate the presence of a scattering of buried debris, steel-bearing objects, or other structures, some of which were noted as visible on the surface. One anomaly, located near the former building footprint, was unexplained. A GPR survey in the area failed to detect any buried objects or other cause for the anomaly.

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